RIVISTA ITALIANA DI ECONOMIA DEMOGRAFIA E STATISTICA

SIEDS
SOCIETÀ ITALIANA
DI ECONOMIA DEMOGRAFIA E STATISTICA

SEDE LEGALE:
C/O Studio Associato Cadoni, Via Ravenna n. 34 – 00161 ROMA

info@sieds.it

rivista@sieds.it

_____

VOLUME FUORI COMMERCIO – DISTRIBUITO GRATUITAMENTE AI SOCI

INDICE

THE MEASUREMENT OF ABSOLUTE POVERTY IN ITALY: AN OVERVIEW AND A REVISION BASED ON THE DATABASE OF REAL ESTATE LEASES OF THE TAX AGENCY

Andrea Cutillo

1. Introduction

In November 2021, the Italian National Institute of Statistics (Istat) established an Inter-institutional Committee with the aim of revising the absolute poverty methodology. The absolute approach of Istat involves identifying basic needs related to food, housing and non-food basic needs, and calculating the cost of the basket of goods and services required to meet these needs. This cost (i.e., the poverty line) varies according to household composition (by number and age of members) and living area (the geographical area of residence and the demographic size of the municipality). Poverty status is assessed through the Household Budget Survey (Hbs). If a household's consumption expenditure is below the poverty line, the household is classified as absolute poor. The methodology needs to be revised periodically to take in account changes in basic needs, as well as the availability of new data sources for defining needs and costs.

In this paper we show the results obtained through the use of the Database of real estate leases of the Tax Agency (Banca dati delle locazioni immobiliari dell'Agenzia delle Entrate), which is a census database with all leases existing at a given time in Italy. This is a new data source available for Istat for reviewing the monetary value of the housing component of the poverty line in a more accurate way than what has been done to date. Through the use of this administrative source, it is indeed possible to avoid the use of the current methodology, which is based on the use of a statistical model on the Hbs data. In addition, it is possible to obtain a more disaggregated territorial classification for poverty estimates, at Nuts II level.

Section 2 describes the Italian approach to measuring absolute poverty; Section 3 shows the use of the Database of real estate leases of the Tax Agency on the rent component of the absolute poverty line; Section 4 concludes.

2. The Istat absolute approach for poverty measurement

Research on poverty measurement differs in many methodological aspects (Lemmi et al., 2019): the time period to be considered to identify poverty, i.e., static or dynamic (Chen and Ravallion, 2013; Jenkins and Van Kerm, 2014); the dimensions to be considered to capture a state of poverty, i.e., unidimensional or multidimensional (Sen, 1991); the measure of households' economic well-being, i.e., objective or subjective (Goedhart et al., 1997). In the case of objective measures, the definition of poverty, whether absolute or relative (Townsend, 1979; Sen, 1983); and the proxy of living standards chosen when following a unidimensional approach, e.g., income, consumption or wealth (Garner and Short, 2010; Brandolini et al, 2010; Kuypers and Marx, 2018).

The Italian National Institute of Statistics developed in 2009 a methodology for calculating the household's "minimum acceptable expenditure" for measuring absolute poverty (Istat, 2009). The proxy for economic status used to measure living standards is consumption expenditures.

Poverty in developed countries has often been estimated through a relative approach, in which the poverty line is usually defined with respect to the standard of living of the reference population (usually by setting the line at some proportion of the mean or median of the income or consumption distribution). However, in recent years, the importance of relying on an absolute approach is growing in developed countries as well (Ravallion, 2016). In fact, relative poverty reflects inequality more than households' lack of resources (Darvas, 2017). In other words, relative poverty is basically a measure of inequality. For developed countries, the absolute poverty line should be viewed as a kind of "minimum acceptable" standard of living in the social context in which households and individuals live rather than the lack of resources such that people's lives are at risk. Under the absolute approach, the value of the poverty line is established independently of the income/consumption distribution, that is, the poverty line is exogenous to the income/consumption distribution. In other words, the poverty line is independent of whether or not other individuals in a society lack the same minimum requirement (Sen, 1983). To identify absolute poverty lines in developed countries, researchers should therefore focus on the basic needs for living in dignity in the social context in which households live. Once these needs have been identified, they should be "translated" into a basket of goods and services to be valued in monetary terms. The growing relevance of the absolute approach even for developed countries is evidenced by the recent European Union project "Measuring and monitoring absolute poverty - ABSPO," aimed at facilitating data collection for measuring and monitoring absolute poverty at the European, national and regional levels (JRC, 2021).

Regarding the proxy of economic well-being to be used for comparison with the poverty line, the literature on inequality and poverty has extensively discussed the pros and cons of different variables to be used. In most cases, when following a unidimensional monetary approach, the economic condition is analysed through income, consumption or wealth. As for wealth, correctly measuring its value is extremely complex and it is not often considered in studies of inequality and poverty[1].

The main drawback of income as an indicator of household well-being is that it can be affected by temporary fluctuations that do not seriously change economic well-being, especially when households can use savings. It has therefore been argued that consumption expenditure may be a better proxy for well-being than income, since consumption reflects, to some extent, the long-run resources of households rather than simply the current income (Friedman, 1957; Modigliani, 1966). It is therefore more stable over time, regardless of short-term income fluctuations. For these reasons, Istat chose to adopt a consumption-based measure[2]. Thus, the underlying conceptual model predicts that economic well-being is derived from consumption expenditures, which in turn depend on income. Absolute poverty in Italy is calculated using the Italian Household Budget Survey, where a household is considered poor when expenditures are below the absolute poverty line attributable to that household.

Absolute poverty lines are defined in Italy by identifying basic needs related to food, housing and non-food basic needs, and calculating the cost of the basket of goods and services required to meet these needs. This cost (i.e., the poverty line) changes according to household composition (according to the number and age of household members) and area of residence (the geographical area of residence and the demographic size of the municipality).

The first step is to identify individual and family essential needs. The second step is the identification, for each essential requirement, of specific goods and services to be included in the basket in order to synthesize basic needs. The third step is the monetary valuation of the goods and services in the basket, in order to obtain a poverty line to be compared with the household's consumption expenditures.

Basic needs are considered homogeneous throughout the country, while the costs of goods and services included in the basket differ from one geographical area to another, reflecting the differentiated cost of living in different areas.

The basket consists of three components: i) food and beverages, which refer to the concept of adequate food; ii) housing, which refers to the availability of a dwelling of adequate size according to the size of the household and equipped with

---

[1] For example, some types of wealth are easily concealed (e.g., cash, paintings), and the attribution of value to wealth is arbitrary when some types of wealth are not sold or bought in the market (e.g., houses).
[2] The main drawback of consumption is that it could be influenced by individual preferences.

lighting, heating, hot water and some durable goods; and iii) a residual component, which includes the minimum necessary to dress, communicate, be informed, move, be educated and be healthy.

The housing component is in turn divided in four sub-lines: the rent component, the electricity component, the heating component and the durable goods component.

According to 2019 data, the food and drink component accounts on average for 35.7% of the poverty thresholds, the rent component accounts for 32.3%, the other dwelling components account for 8.7% and the residual component for 23.2%.

Some of the components of the poverty line are estimated through coefficients obtained from models run on the Hbs data, so they are somewhat endogenous to the survey data. However, in the absolute approach it would be much better to obtain poverty lines completely exogenous to the survey data.

Poverty thresholds were calculated with 2005 as the base year. To adjust the thresholds for price changes over time, specific price indexes are applied annually for each good and service considered in the basket. Assuming that price trends may also differ in different areas of the country, inflation rates are considered by area.

2.1. The components of the poverty line[3]

Food and beverage component: The food and beverage basket was identified through a nutritional model defined by Istat and the National Institute of Nutrition. The food and beverage needs of individuals (by sex and age groups) were defined by translating the recommended intake levels of foods into combinations of average daily amounts of foods at the individual level, expressed in grams for each type of food. These requirements are assumed to be independent of individual preferences. To determine the monetary value of individual food combinations, data from the consumer price survey conducted by Istat were used, and the combination of foods needed by an individual in a certain age group multiplied by the unit prices of the specific foods in the geographical area of residence provides the monetary value of individual nutritional needs.

Adding up the individual monetary food needs yields the monetary value of the household basket. The monetary value of the basket is then modified through specific "savings coefficients," which are applied to consider the effect of possible savings actions: larger households may save money by buying larger quantities of food or, conversely, smaller households may pay more by being forced to buy the minimum package.

---

[3] For a more in-depth description see Istat (2009) and Cutillo et al. (2022).

The housing component: the housing component takes into account both the availability of a dwelling (i.e., the cost of rent) and the services that the house must contain (i.e., electricity, heating, and some durable goods). The minimum housing requirement is defined through a ministerial decree, which defines the parameters for granting habitability (Ministerial Decree 5/7/1975).

The rent subcomponent accounts for most of the housing component. The estimation model is based on a suitable dwelling size that varies with household size and on price per square meter. To account for the differentiated cost of the housing market in the different areas, the price varies by type of municipality and geographic area of residence.

The monetary value of the rent component for a household of size z, residing in the geographical area k and in a municipality of type c is defined as:

$$ac_z^{kc} = spl_z * \widehat{cm}^{kc} \tag{1}$$

where spl_z is the suitable surface for a household of size z (as defined by the Ministerial Decree 5/7/1975) and $\widehat{cm}^{kc}$ is the estimated monthly expenditure per square meter for rent of households residing in the type c municipality of geographical area k.

The parameter $\widehat{cm}^{kc}$ is estimated through the following model based on Hbs 2003-2005 data:

$$cm^{kc} = b_0^c * exp\left(-sp^{b_1^c + b_2^c ds}\right) \tag{2}$$

where sp is the surface of the dwelling and ds is a dummy variable which takes value 1 if the household is resident in the South or Islands and 0 otherwise.

The other housing sub-components consider the services that the dwelling should contain (electricity, heating and some durable goods). The minimum threshold for energy consumption has been defined by the Electricity and Gas Authority, differentiated by household size. This threshold is expressed in kilowatt hours, and the monetary value is based on the application of the tariffs in force. Electricity expenditure was assumed to refer to the use of television, washing machine and refrigerator in addition to lighting. The heating component, including water heating, was estimated through a model based on 2003-2005 Hbs data, by geographic area, household size and household type. Expenditures that a household incurs for the purchase of some basic durable goods (refrigerator, cooking machine, washing machine, TV) were based on the calculation of depreciation quotas, which were obtained on the basis of consumer prices and their average duration.

The residual component: Food and housing alone do not provide a complete picture of the needs of individuals and households. A residual component was calculated, and includes the minimum goods and services needed to dress, communicate, be informed, move, be educated, and be healthy, estimated as a

function of food and beverage expenditures. The residual component is thus a function of the monetary value of the food basket and also takes into account age and number of household members. The estimate is based on a statistical model on Hbs 2003-2005 data.

The monetary value of the total basket, given as the sum of the individual components, was obtained for 2005. Each component is revalued annually, differentiating consumer price trends with respect to specific indexes of goods and services and with respect to the area of residence.

3. The use of the Database of real estate leases of the Tax Agency on the rent component

Along with all the other possibilities regarding the other components, the aim of this paper is to show the potential of changes on the calculation of the rent component. In particular, Istat has the possibility of using the Database of real estate leases of the Tax Agency (Banca dati delle locazioni immobiliari dell'Agenzia delle Entrate - henceforth, also called Omi database), which is a census database on all active rents in Italy at a given time. This database has great potentials, particularly in three respects. First, it is a source completely exogenous to the Hbs data; second, since it is a census database, it is possible to avoid the estimation of an econometric model, thus avoiding the uncertainty arising from the choice of the model and form the model itself in terms of standard error. Finally, a more disaggregated territorial classification can be considered.

Regarding the first topic, it can be noted that the current methodology is based on an econometric model on Hbs data. In this respect, the coefficients estimated on survey data makes the methodology somewhat endogenous with respect to the distribution of consumption as measured by the survey, whereas for the absolute approach it would be better to obtain poverty lines that are completely exogenous to the survey data.

Regarding the second argument, every statistical model is affected by uncertainty. Therefore, the Interinstitutional Commission has preferred to avoid using a statistical model, and the cost of rent per square meter is calculated through cells determined by the intersection of dwelling size, territorial domain (geographical area at NUTS I level) and type of municipality. This means that rents are stratified by geographic area, municipality type and class of surface.

Thus, the monetary value of the rent component for a household of size z, residing in the geographical area k and in a municipality of type c is redefined as:

$$ac_z^{kc} = spl_z * \widehat{cm}_z^{kc} \qquad\qquad (3)$$

where spl_z is still the suitable surface for a household of size z and $\widehat{cm}_z^{kc}$ is the cost per square meter for a dwelling that has surface suitable for a household of size z residing in the type c municipality of geographical area k.

As well as the methodology currently in use, the suitable surface defined by Ministerial Decree 5/7/1975 is modified to take into account the lack of small dwellings in Italy (Table 1). Therefore, the Decree's parameters are replaced by classes of surface, and the central value of the classes are used for obtaining spl_z. For example, the Decree's parameter 28 for a one-person household is replaced by the surface class 28-37 square meters, and 32.5 square meters is the suitable surface used for estimates. The "modified suitable surface" is then multiplied by the estimated cost per square meter ($\widehat{cm}_z^{kc}$) in order to obtain the rent threshold. $\widehat{cm}_z^{kc}$ is identified through the median value of the cost per square meter in each cell as defined by the interaction between z, k and c.

Table 1 – *Minimum size of the dwelling by household size (squared meters).*

	Household size					
	1	2	3	4	5	For every additional component
DM 1975	28	38	42	56	66	+10
Class of surface	28-37	38-41	42-50	56-60	66-70	+10
Central value of the class	32.5	39.5	46	58	68	+10

Source: Ministerial Decree 5/7/1975 and Istat (2009)

A strict selection of lease contracts is applied before stratification. First, only long-term contracts (4+4 years and 3+2 years) are considered. These contracts are the ones usually signed for renting houses to private households. Thus, all short contracts, such as for study or vacation purposes, were excluded. Second, we excluded from the database luxury dwellings, which are not relevant for households in the lower tail of the economic distribution. Luxury dwellings are identified through the land register, and are villas, fine dwellings, and dwellings of historical or artistic significance.

Table 2 presents the results obtained with stratification versus those obtained with the current methodology. The results are disaggregated by geographic area and type of municipality. It can be seen that the overall results are consistent, as the average rent threshold on 2019 Hbs data is about the same (334 vs. 333 euros per month). However, there are significant differences when looking at the classification by geographic area (e.g., the average value for the Centre is 408 vs. 392 euros) and, even more, by type of municipality. With the current methodology, the average rent threshold for large municipalities is 402 euros, while using the Omi database it is 482 euros (+19.9%). In particular, the average values for large cities in the Centre (Rome and Florence) are revalued by +29.5%.

Table 2 – *Rent component of the poverty threshold by Nuts I level, type of municipality and different methodologies - 2019 (Euros and percentage differences).*

	Type of municipality			
	Centre of metropolitan area	Municipalities of metropolitan area suburbs and municipalities with more than 50.000 inhabitants	Other municipalities	**Total**
	Current methodology			
Nord	420	382	331	**363**
Centro	440	401	345	**392**
Mezzogiorno	290	268	222	**244**
Italia	**402**	**355**	**297**	331
	Nuts I stratification on Omi database			
Nord	508	380	320	**365**
Centro	570	381	315	**408**
Mezzogiorno	302	264	226	**245**
Italia	**482**	**346**	**287**	336
	Percentage difference			
Nord	20.9	-0.6	-3.4	**0.6**
Centro	29.5	-4.9	-8.7	**4.1**
Mezzogiorno	4.3	-1.4	1.7	**0.4**
Italia	**19.9**	**-2.6**	**-3.4**	**1.5**

Source: Elaborations on the Istat HBS and on the Omi database.

Bearing in mind that the current methodology is based on a model using data from 2003-2005 and involves annual revaluation of the threshold through specific price indexes, it probably means that major changes in the housing market in recent years have not been captured. For example, there has been a sharp increase in the value of small-scale housing and housing in large cities compared to large-scale housing and housing in small towns in recent years.

As a consequence, the results on the absolute poverty rate (Table 3) also change (we changed only the rent component of the threshold, leaving the other components unchanged). While the overall value of the incidence remains essentially unchanged (6.5 percent vs. 6.4 percent), the value for large cities increases by 1.5 percentage points, from 5.8% to 7.3 % (and more than doubles in large cities in the Centre).

In summary, the use of the Database of real estate leases of the Tax Agency is a huge step forward in defining the rent threshold. First, it avoids the use of a statistical model. Second, it makes it possible to make the rent threshold completely exogenous to the Hbs data. And third, it allows to take in account the large changes that have occurred in the housing market in recent years. It also allows for a further step forward, namely the use of a more disaggregated territorial classification. So far, we have shown the results obtained from the stratification obtained through the interaction of dwelling size, geographic area, and type of municipality. However, the Omi database is a census database. Therefore, a more disaggregated classification, i.e., at regional level, is possible. This procedure would certainly imply a multiplication of the number of thresholds but, in our opinion, this is an additional

advantage. Indeed, when comparing the expenditures of a single record, one is comparing the expenditures of a household that actually lives in that particular region, and thus has a level of spending that as a matter of fact depends on the region of residence.

Table 3 – *Absolute poverty rate by Nuts I level, type of municipality and different type of calculation - 2019 (percentages and differences in percentage points).*

| | **Type of municipality** | | | |
	Centre of metropolitan area	Municipalities of metropolitan area suburbs and municipalities with more than 50.000 inhabitants	Other municipalities	**Total**
	Current methodology			
Nord	7.1	4.8	6.1	**5.8**
Centro	2.0	4.5	6.3	**4.5**
Mezzogiorno	9.8	8.9	8.2	**8.6**
Italia	**7.1**	**4.8**	**6.1**	5.8
	Nuts I stratification on Omi database			
Nord	8.3	4.8	5.8	**5.9**
Centro	4.2	4.3	5.5	**4.8**
Mezzogiorno	10.4	8.7	8.3	**8.7**
Italia	**7.3**	**5.8**	**6.6**	6.5
	Percentage difference			
Nord	1.2	0.0	-0.3	**0.1**
Centro	2.2	-0.2	-0.8	**0.3**
Mezzogiorno	0.6	-0.2	0.1	**0.1**
Italia	**1.5**	**-0.2**	**-0.3**	**0.1**

Source: Elaborations on the Istat HBS and on the Omi database.

Table 4 presents the results when stratification is obtained through the interaction of region (Nuts II level), household size and type of municipality. It can be seen that the aggregate results are more or less the same: the average rent threshold is 336 euros through NUTS I stratification and 334 across NUTS II stratification. The macro areas also present similar results. In the North the corresponding values are 365 versus 359; in the Centre the same value is obtained, 408 euros; in the South and Islands (Mezzogiorno) the average values are 245 and 249 euros. However, there are large differences when looking at the results by region. In relative terms, the largest increase on the rent threshold is observed for Sardegna (from 235 to 324 euros) and Abruzzo (from 231 to 284 euros), while the largest decrease is observed for Piemonte (from 386 to 295 euros) and Umbria (from 339 to 272 euros). In other words, when considering the differences that exist within a macro area, the results are very different. The significance of these results is that the housing market in Sardegna and Abruzzo has a higher price than the average market in the South and Islands macro area, and the latter cannot be considered as representative of the housing market in these two regions. The opposite is the case for Piemonte and Umbria, which have housing markets with prices lower than the average values of the corresponding macro area. Through regional stratification, Piemonte has a value

equal to 82.2% of the average value in the North, while this value would be 105.5% in the case of stratification by macro area. Since the values come from a census database, there is no margin of error in this regard, and stratification by region is therefore preferable.

Table 4 – *Rent component of the absolute poverty threshold and absolute poverty rate by Nuts II level and different type of calculation - 2019 (Euros and percentage).*

Region	Rent component of the poverty threshold			Absolute poverty rate		
	Current methodology	Nuts I stratification on Omi database	Nuts II stratification on Omi database	Current methodology	Nuts I stratification on Omi database	Nuts II stratification on Omi database
Piemonte	373	386	295	6.0	6.0	4.6
Val d'Aosta	327	317	310	3.6	3.3	3.3
Lombardia	360	361	388	5.1	5.2	5.6
Trentino Alto Adige	348	338	344	3.9	3.7	3.7
Veneto	355	348	357	9.5	9.4	9.7
Friuli Venezia Giulia	345	338	326	3.9	3.4	3.7
Liguria	384	412	355	8.8	9.7	8.7
Emilia Romagna	366	368	374	3.4	3.6	3.4
Nord	**363**	**365**	**359**	**5.8**	**5.9**	**5.8**
Toscana	379	370	409	3.2	3.3	3.4
Umbria	367	339	272	4.5	4.3	2.9
Marche	356	326	319	6.5	5.7	5.7
Lazio	412	462	450	4.9	5.5	5.3
Centro	**392**	**408**	**408**	**4.5**	**4.8**	**4.6**
Abruzzo	233	231	284	4.9	5.1	6.8
Molise	222	220	229	4.0	4.4	4.9
Campania	253	257	255	9.8	9.9	9.9
Puglia	245	246	248	8.0	8.0	8.0
Basilicata	232	231	193	6.0	5.7	3.5
Calabria	233	232	201	10.0	9.9	9.4
Sicilia	246	249	235	10.5	10.7	10.3
Sardegna	236	235	324	3.6	3.9	4.6
Mezzogiorno	**244**	**245**	**249**	**8.6**	**8.7**	**8.6**
Italia	**331**	**336**	**334**	**6.4**	**6.5**	**6.4**

Source: Elaborations on the Istat HBS and on the Omi database.

4. Conclusions

In this paper, we have shown the great potential of using the Database of real estate leases of the Tax Agency to revise the rent component of the absolute poverty line. First, the use of a statistical model can be avoided, as the database is complete with all existing tenancies. Second, it is possible to obtain rent thresholds that are completely exogenous to the Hbs data. Third, it is possible to obtain a more

disaggregated territorial classification, at regional level. Obtaining regional thresholds is a major advance that can be achieved in the ongoing activities to revise the absolute poverty methodology. Currently, the estimation domain of absolute poverty is only at the NUTS I level, for a couple of reasons: the sample size was small and absolute poverty was a rare phenomenon, with obvious consequences on sampling errors. However, already in 2020, the sample size was enlarged from 19,550 to 32,500 households. Moreover, absolute poverty can no longer be considered a rare phenomenon (it has increased from 3.5 percent in 2005 to 7.5 percent in 2021). Therefore, the time has come to implement a sample design that allows absolute poverty to be known at the Nuts II level. In this case, having more reliable thresholds at the regional level would be the first and perhaps most important step. Moreover, just as the threshold for rent, also the food and drink component can now be calculated at the regional level and no longer just at the macro-area level. If we also consider that the residual component is a function of the food and beverage threshold, it follows that also the residual component can be considered as regionally dependent. That is, on average, about 92 percent of poverty lines would be made up of regional components, and only 8 percent would be made up of macro-area components (basically, the heating, energy and durable goods components).

References

BRANDOLINI A., MAGRI S., SMEEDING T. 2010. Asset-based measurement of poverty. *Journal of Policy Analysis and Management*, Vol. 29, No. 2, pp. 267–284.

CHEN S., RAVALLION M. 2013. More relatively-poor people in a less absolutely-poor world. *Review of Income and Wealth*, Vol. 59, No. 1, pp. 1–28.

CUTILLO A., RAITANO M., SICILIANI I. 2022. Income-Based and Consumption-Based Measurement of Absolute Poverty: Insights from Italy. *Social Indicators Research*, Vol. 161, pp. 689–710.

DARVAS Z. 2017. Why is it so hard to reach the EU's poverty target? *Policy Contribution Issue No. 1*, Bruegel, Brussels.

FRIEDMAN M. 1957. *A theory of the consumption function*. Princeton: Princeton University Press.

GARNER T., SHORT K. 2010. Identifying the poor: Poverty measurement for the U.S. from 1996 to 2005. *Review of Income and Wealth*, Vol. 56, No. 2, pp. 237–258.

GOEDHART T., HALBERSTADT V., KAPTEYN A., VAN PRAAG B. (1997). The Poverty Line: Concepts and Measurement. *Journal of Human Resources*, Vol. 12, pp. 503-520.

ISTAT. 2009. *La misura della povertà assoluta*. Rome: Istat, Argomenti No. 24.

JENKINS P., VAN KERM P. 2014. The relationship between EU indicators of persistent and current poverty. *Social Indicators Research*, Vol. 116, No. 2, pp. 611–638.

JRC. 2021. *Measuring and monitoring absolute poverty (ABSPO)*. Brussels: European Commission.

KUYPERS S., MARX I. 2018. Estimation of joint income-wealth poverty: A sensitivity analysis. *Social Indicators Research*. Vol. 136, No. 1, pp. 117–137.

LEMMI A., GRASSI D., MASI A., PANNUZI A., REGOLI A. 2019. Methodological Choices and Data Quality Issues for Official Poverty Measures: Evidences from Italy. *Social Indicators Research*, Vol. 141, No. 1, pp. 299-330.

MODIGLIANI F. 1966. The Life Cycle Hypothesis of Saving, the Demand for Wealth and the Supply of Capital. *Social Research*, Vol. 33, No. 2, pp. 160–217.

RAVALLION M. 2016. *The Economics of Poverty*. Oxford: Oxford University Press.

SEN A. 1983. Poor, relatively speaking. *Oxford Economic Series*, Vol. 35, No. 2, pp. 153-169.

SEN A. 1991. *Capabilities and Well-Being*. New York: United Nations University Press.

TOWNSEND P. 1979. *Poverty in the United Kingdom: A Survey of Household Resources and Standards of Living*. London: Penguin Books.

SUMMARY

The absolute approach to poverty involves identifying basic needs (food, housing and non-food) and calculating the cost of the basket of goods and services required to meet these needs. The cost of the basket, differentiated by household type and territorial area, represents the poverty threshold, which should be exogenous to the distribution of the proxy variable used to assess economic well-being (consumption expenditures the Household Budget Survey). The methodology needs to be revised periodically to account for changes in basic needs and the availability of new data sources. In particular, Istat has now at its disposal the Database of real estate leases of the Tax Agency. This paper shows the results obtained through the use of this administrative source to review the monetary value of the rent component of the absolute poverty line. In fact, it is a census database with all leases existing at a given time, making it possible to avoid using the current methodology, which is based on a statistical model on Hbs data. In this way, two key advances can be achieved. First, it is possible to obtain rent thresholds that are completely exogenous to the Hbs data, in a way that is entirely consistent with the absolute approach. Second, it is possible to obtain a more disaggregated territorial classification for poverty estimates, at the regional.

_____

Andrea CUTILLO, Istat, cutillo@istat.it

VULNERABLE FAMILIES AND CHILDREN EXPOSED TO THE COBRA EFFECT: INSIGHTS FROM A POSITIVE AND NORMATIVE ANALYSIS[1]

Monica Airoldi, Arianna Carra, Daniela Corso, Stefania Della Queva,
Sabrina Stoppiello, Flavio Verrecchia

1. Introduction

In the colonial epoch of British control over India, to combat a snake infestation, the governor promised money for each dead snake delivered to the authorities. This policy worked for some time, then, when snakes became scarce, people began to breed snakes and then kill and deliver them. Once the fraud was discovered, the policy was revoked. The negative result was not only the waste of money, in fact, as the snakes were no longer useful, the population released the snakes, so that at the end of the policy, the snake infestation was greater than it was at the beginning (Siebert, 2002). From this legendary story, in which solutions make problems worse, the *"cobra effect"* gets its name. More generally, in the context of social policy evaluation, one can speak of unintended (of intended actions) when a policy triggers unexpected outcomes (Stame, 2000). The cobra effect is the worst case regarding the results of policy failure with unexpected negative effects: the policy not only does not affect the problem, it amplifies it. This is not the only known case of unintended consequences of a policy. It also occurred, for instance, with the 1902 Hanoi rat massacre under French colonial rule (Vann, 2003). There is no lack of cases involving children either. In 1956, the Canadian federal government paid 70 cents per day for each orphan and $2.35 for each psychiatric patient (Dupuis, 2020). It is alleged that as many as 8,000 orphaned children in Quebec were falsely certified as mentally ill in order to receive a higher payment.

"On March 17, 1955, Herve Bertrand was an ordinary 11-year-old boy attending classes at Mount Providence orphanage in Montreal. On March 18, he became an idiot [...] Sister Collete Francois come in around 10 or 11 o'clock and said: 'From today there will be no more school. Gather up your personal affairs and return to your dormitories. From Today onward, you are all crazy, mentally retarded" (The Prescott Courier, 1993).

In Italy, the so-called *"Angels and Demons"* Bibbiano investigation, into the Val d'Enza residential services scandal, showed an alleged illicit system of managing minors through false reports by social workers and psychologists, falsification of

---

children's testimonies, manipulation and violence. It should be noted that policies for residential services provide average daily fees per child hosted up to 118 euros in Veneto and Emilia Romagna states CNCA - Coordinamento Nazionale Comunità di Accoglienza (Zancaner, 2019), much more expensive than supporting vulnerable families. Although we are not interested in the condemnations there have been, it is worth noting that every family unit from which the investigation had started was reconstituted by juvenile court rulings, which saw no reason why those children should not stay with mom and dad, a fact, the latter, sufficient to suggest the presence of the cobra effect in Italian cases as well.

In this framework, the focus of the study concerns a particular population: minors placed outside their families of origin and received in foster families and residential services. Our research started from the analysis of available official statistical sources with the observation of both the supply of residential services, through the availability of Istat's Continuous Census of Non-profit Institutions (Paragraphs 2 and 3), and the use of such establishments, thanks to the dossiers of the Ministry of Labour and Social Policy (Paragraphs 4 and 5). Real cases shared by Telefono Arcobaleno are useful for "hands-on" and better understanding of the phenomenon (Paragraphs 6 and 7). Data and real cases are supplemented by normative analysis (Paragraph 8). Final considerations close the paper.

2. Nonprofit Institution Continuous Census

The year 2015 marks for Istat the start of the new era of general censuses: population and economic units are not more surveyed every decade but continuously. The permanent census method is based on periodic (annual, biannual or triannual) sampling integrated with information from basic statistical registries. The Continuous Census of Non-Profit Institutions[2] (NPIs) will thus allow Istat to produce relevant annual data on the structural characteristics of the nonprofit sector. These data are to be completed by triannual sample focus surveys concentrating on selected dimensions and particular aspects of Italian non-profit institutions. In 2016 Istat realized the First Continuous Census of NPIs, based on the integration of the results of the thematic sample surveys and of the statistical register, with the following aims: i. update, and make consistent, information regarding the nonprofit sector in Italy along its economic and social dimensions; show its peculiarities and organizational characteristics through a series of thematic focuses, while guaranteeing the time

---

[2] According to international definitions (SNA 1993, 2008), nonprofit institutions are "legal-economic units with or without legal personality, private in nature, which produce marketable or non-marketable goods and services and which, according to applicable laws or their own bylaws, do not have the power to distribute, even indirectly, profits or other gains other than remuneration of work performed to the persons who established them or to their members".

series information; ii. meet the national and international informational needs by providing data necessary for the realization of the Nonprofit Satellite Account; iii. build a system of statistics comparable at the international level on the basis of the criteria established by the *Handbook* (United Nations, 2003, 2018); iv. enlarge the availability of the informational assets about the sector in the administrative data archives; v. reduce statistical burden and costs. In 2018, Istat released the 2016 Statistical Register of NPIs updated to the current context, the First Continuous Census classified the nonprofit institutions according to the principal heuristic variables (already indicated in international references) such as the typology of economic activity (market / non-market), the scope with respect to the typology of beneficiaries (mutualistic / of public utility), and the primary source of financing (public / private). Information was provided on activities performed (primary and secondary); services provided and their beneficiaries or objectives; human resources engaged (paid and unpaid) and their principal characteristics (categories and professional profiles); economic and financial dimensions and budget components; modalities and tools of communication and fund-raising. The first continuous census of nonprofit institutions is based on a sample survey from the Statistical Register of NPIs. Sample estimates are calculated from the known totals of the reference population. No quantitative data available on beneficiaries.

3. Child-oriented non-profit institutions and disadvantage

Census surveys on NPIs make it possible to detect information on the structure, human and economic resources, activities carried out, and peculiarities of the Italian nonprofit sector, as well as the categories of hardship toward which they deliver services and also the prevailing age group of users. By a specific question of questionnaire, it is possible to analyze the role of NPIs in caring for children through the provision of various services and also to observe the weight of these institutions in supporting social distress. In 2015, there are more than 60,000 NPIs that address children under the age of 18 (predominantly) and represent 18% of the entire sector. They are concentrated in five areas of activity: i. Sports with management of sports facilities, organisations of sports courses, organisations of sports events (47%); ii. Other recreation and social clubs: organisation of events, feasts, celebrations and other events, management of centres for leisures and socialisation (14%); iii. Culture and arts: organisation of theatre shows, musicals and movies (11%); iv. Social services: management of day care centres (including summer centres) and semi-residential facilities (10%); v. Primary and secondary school in particular education in maternal school (9%). These are activities that play a central role in caring for the development and growth of children and their well-being, through recreational and

socialization activities but also with attention to the world of culture and schooling. Almost one third of the NPIs dealing with minors (predominantly) target groups with specific hardship (18,130, equal to 29.9%). In 52.2% of cases, they address their services to people with physical and/or mental disabilities, in 33.7% to people in economic difficulties and in 25.1% to minors in difficulty. There are 1,099 vulnerability-oriented NPIs that run residential social welfare facilities (excluding those that provide health services) and mainly target minors under 18 years of age, while 6.1 percent of NPIs that deal with minors target - mostly - groups with specific hardships (Figure 1): minors in distress (66.8%), people in economic distress (33.4%), people with physical and/or intellectual disabilities, (25.4%) people with psychological/social difficulties (22.7%), unaccompanied foreign minors (21.0%), people who are victims of violence, abuse and/or mistreatment (14.3%) people who are homeless or have housing problems (13.8%).

Figure 1 – *NPIs predominantly targeting children under 18 years of age, oriented to vulnerability and running residential social welfare facilities (excluding those providing health services) by types of vulnerability. 2015 (percentage values).*
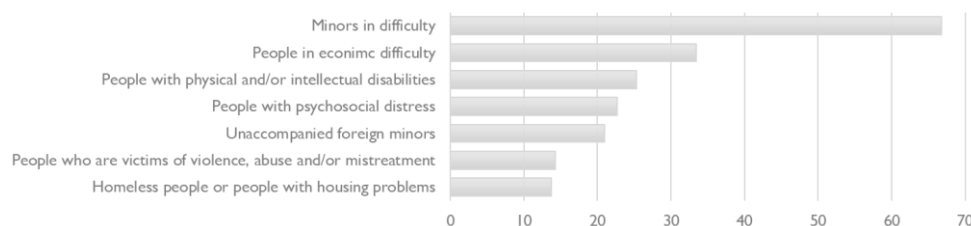
Notes: Minors in difficulty. This includes minors removed from the family nucleus and/or cared for other reasons (not recognised at birth, death or presumed abandonment of the parents).

4. The available data sources on young people outside their family of origin

The main data available on the phenomenon of the reception of children and young people *"outside their family of origin"* and, therefore, placed in foster care with families or in residential facilities for minors can be obtained from the dossiers of Ministero del lavoro e delle politiche sociali - ML (2018, 2020, 2021). It should be pointed out that for not all regions the data is up to date. The data are joined with those of unaccompanied foreign minors (msna), who present, by their very nature of being "alone on the territory". characteristics and starting conditions quite different from those of children and young people who are removed from their families of origin by virtue of protection measures ordered by the Juvenile Court. If, in the examination of foster care cases, the data are subject to presumably "limited" distortions, since, at the end of 2019, there were about 500 msna, the picture becomes

more complicated in the matter of admissions to residential facilities, since, again at the end of the same year indicated, these minors exceeded 3,000 units. The data, especially those relating to minors in residential services, have a series of 'anomalies' that, in fact, preclude the possibility of a robust analysis of the phenomenon. In fact, the first consideration concerns the presumably different average age of msna and the rest of the aggregate of children and adolescents aged between 0 and 17 hosted in residential facilities. Of the first subset, it is stated that the subjects are *"almost exclusively concentrated in the age range close to reaching majority"*. This, in particular, has the almost immediate effect of lowering the average duration of care, especially if this is compared with the duration of foster care. The lack of diversified observation of msna and other minors hosted in residential services also leads to a distortion in the measurement of the different outcomes related to discharge from the facilities, this leads to an increase in the weight of the *"unknown destination"* modality, which can be translated in terms of escape from the facility, which instead is almost unknown in foster care cases. Concerning young people placed in residential services we observe: i. for some regions, the data provided also include minors with their own parent, whether a minor or an adult; ii. sometimes minors taken in with their mothers in sheltered homes are included. In order to have useful information in the study of the phenomenon, it is necessary to promote better data collection especially regarding the variables that influence it.

5. Positive analysis on young people outside their family of origin

In Italy, in 2019, the number of minors placed in foster families and residential services is approximately 28,000 (in 2010 there were approximately 26,000). The growth of the phenomenon over the last decade, +8%, is actually due to two diverging trends: i. a contraction in family foster care (-6%); ii. an increasing use of residential services (+25%), with the population of minors in 2019 exceeding 14,000. In the cross-country comparison, a different propensity for activating family fostering rather than residential placement emerges, quantifiable in the numerical ratio between the two foster care tools. In 2017, family foster care is the prevalent foster care instrument in the United Kingdom (2.6) and France (1.8). The situation is different in other European countries such as Italy and Spain (1.1) and Germany (1.0). In Italy, there is such a negative trend that since the last two years there has been a greater propensity for residential placement (1.28 in 2010 vs. 0.96 in 2019). This fact is also confirmed in trend terms, from the models applied to the available data with parameters estimated with least squares[3]: for children placed in families

---

[3] In general, the derivative with respect to the parameter a_s is: $\partial Q/\partial a_s = -2/N \ \Sigma_i \Sigma_j (y_i - \Sigma^K_{h=0} a_h x_i^h) \ x^s_i \ n_{ij} \ (s=0,1,\ldots,K)$.

the angular coefficient is negative (-52), while for children in residential services it is positive (238). More than half (50.9%) of the children placed in residential services stay more than one year in residential establishments. 12% of minors dismissed from residential facilities in 2019 have an "unknown destination", i.e., they are on the run (vs. 3% in family foster care). While nationally only 24.3 percent return to their family of origin, in Tuscany, Molise and Lombardy, with indices below 70 (Figure 2) the situation is even more critical, as this share amounts to less than one-sixth. Only for earlier years (2016), data is available on the main reason for placement of children and young people aged 0-17 years (ML, 2018, Tab. 2, p. 9): unbelievably *'Family economic problems'* appears among other items in both family fostering (1.1%) and residential services for children (2.3%).

Figure 2 – *Share of children in residential services who return to family of origin, by region, Italy, 2019 (index, Italy 24.3% = 100).*
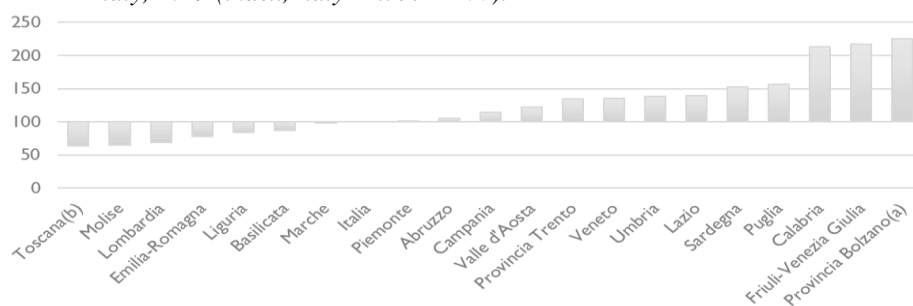
Source: ML (2021). Notes: *(a) Partial data, minors cannot be separated out; (b) Minors present with their parent, whether the parent is a minor or an adult, are also counted.*

6. Real case 1: From intra-family violence to «family». From family to the breakdown of family ties

Considering the initial life context, we observe a family abuse with minors. Mother rescues children from violence by flying to Italy, where she has difficulties in finding an occupation (due to language and low level of education). This leads the family to related social isolation, socio-economic and cultural unhealthy hardships as well as housing conditions and a lack of fulfilment of children's basic needs. In terms of reporting and protection interventions the school reports the case to Telefono Arcobaleno (T.A.): in the first intervention phase (systemic support in emergencies) housing conditions are made healthy and functional, legal aid and support for the parent's job placement were activated, as well as the territorial (school, church, community) involvement to support the family unit. The following services have also been implemented: home education, psycho-educational support

for minors and parenting support service (to "accompanying" parenting function, made vulnerable by violence and poverty conditions). The assessment of recoverability of parental resources is positive: the mother is able to identify the needs of her children but is currently unable to meet them. We can observe that we are faced with an evolutionary process that is crucial for building a relationship of trust in the territorial services that can lead to success in this family. In the second intervention phase (non-systemic support and evaluation) the assessment and intervention of the Child Neuropsychiatry (CN) and the Municipality Social Service lead to: i. Activation of home education service (not sufficient with respect to real needs); ii. Activation of the CN Service for the assessment (but not intake); iii. psychological interview with the parent (perceived as evaluative by the mother); iv. Limited management of socio-economic problem; v. involvement of the Juvenile Court. The outcome of this intervention is the assessment of parental inadequacy (the mother is not capable) and the placement of minors in two different residential facilities. Therefore, it was chosen to activate a residential service for minors instead of investing in home education and parenting support service: the outcomes are that not enough has been done to create the conditions for responsible parenting; the children's right to grow and be educated in their own family is not guaranteed (Figure 3). The intervention amplified fragilities and weakened family ties.

Figure 3 – *Outcomes: Costs.*

- **Costly** maintenance of minors in the Community
- **Lack** of recoverable parental resources
- **Loss** of family ties
- Children's right to grow and be educated in their own family and the right to continuity of affection are **not guaranteed**

7. Real case 2: From the fragmented, conflicted and deprived family to the family protected by institutions

Considering the initial life context, in this real case we observe a separated family with minors who live with their mother and don't see their father and paternal line relatives in the last two years. Children were born when both the parents were minors. The separation occurred when the children were still kids. In addition, we find: i. High parental conflict and a lack of support from paternal and maternal families of origin; ii. Lack of fulfilment of children's basic needs; iii. Unhealthy housing conditions of the minors; iv. Job insecurity and cultural, social, and economic hardship; vi. Stigmatisation and social isolation of the mother. Finally, a distrust of territorial services emerges. In terms of Protection interventions, the Ordinary Court intercepts the needs of the family unit in a civil proceeding, each of

the two parents ask for sole custody of the children. The mandate to the Child Protection Service of T.A. consists of the following support and evaluation interventions: i. Socio-environmental assessment; ii. Parenting support pathway; iii. Decision-making process on the child custody and placement regime; iv. Indication of any further intervention deemed necessary to support the parents or the minors themselves.

Figure 4 – *Outcomes: Costs and benefits.*

Costs
▪ Considerable **investment** of different territorial services
▪ **Strenuous** (but possible) networking

Benefits
▪ Investment of **reduced economic resources** compared to those required by an intervention in residential facilities
▪ **Development** and **maintenance** of affective relationships within one's own household and restored family ties
▪ Children's right to grow and be brought up in their own family **guaranteed**
▪ **Created** «the conditions for positive and responsible parenting»
▪ **Honoured** the need to «bear in mind the need for every child to grow up in a caring and supportive environment, actively counteracting the emergence of situations that lead to the separation of children from their families by **accompanying vulnerable parenting** and the consequent articulation between the sphere of protection of "minors" and that of support for parenting»

T.A. proposes: i. Temporary fostering of the family unit to the Municipality's Social Service; ii. Placement with the mother; iii. Deployment of all useful territorial resources as there are clear signs of recoverability of parenting skills. Following the positive improvement of the initial prejudice and discomfort conditions T.A. informs the Judge that overcoming the condition of prejudice for minors depends on the intensity of public support and intervention that can be mobilized in favor of the family nucleus. The Court, therefore, orders the temporary custody of minors to the Municipality's Social Service and their placement in the maternal home. In addition, the judge jointly instructs T.A., the Municipality's Social Service and the Health Care Services to: i. activate a strong support project for the mother aimed at promoting the progressive improvement of her current working, income and housing conditions and activation of the home education service at the maternal home where the minors are placed; ii. extend the support path to parenthood, also in order to facilitate the maintenance of the emotional relationship, recently reactivated, with significant adults in the context of the life of minors; iii. activate a path of psychological support for minors; iv. monitor the evolution of the living conditions of minors. The outcome achieved is that the minors are now living with their family, the family ties are all restored, and the parents respond positively to the intervention program (Figure 4).

In this case it was chosen to activate an intense public and private support in favor of the family unit, in order to improve the living conditions of minors within their

family life context. It was therefore chosen to invest in home education and parenting support service rather than in the placement of minors in residential structures. The conditions for positive and responsible parenting and the guarantee of children's right to grow and be educated in their own family are safeguarded.

8. Normative analysis

From a normative point of view, there seems to be no gradualness in the funding, use and prescription of the available instruments. Family fostering and residential services should be the last resort, after having adopted all the other possible measures to support the nucleus. Are we therefore faced to the cobra effect? It can be observed that in contrast to what is observed from data, angular coefficients (see para. 5) and real case 1, there is not only the law[4] and judgments[5] there are also Ministry guidelines. In theory, the right of every child to live in his or her own family is guaranteed (Figure 5, 102). For the realization of this right in all regions (Figure 5, 020), the law establishes four cardinal principles: i. the vulnerable family must be supported with appropriate interventions to prevent the removal of children (Figure 5, 030); ii. when it is temporarily impossible for the child to live in his or her family of origin, the Italian legal system provides the instrument of family foster care (Figure 5, 110.1) as a brief parenthesis of life outside the family context of origin, without breaking the bond with the family of origin (Figure 5, 110); iii. where family foster care is not possible, placement of the child in a family-type community is allowed; iv. subject to the fact that there are no family-type facilities on the territory, placement in a public or private care institution is possible (Figure 5, 102).

---

[4] Law No 184, May 4, 1983, as amended by Law No 149, March 28, 2001: i. The child has the right to grow up and be educated within his or her family; ii. The poverty of the parents or of the parent exercising parental responsibility may not be an obstacle to the exercise of the child's right to his or her own family. To this end, support and assistance shall be provided for the family.

[5] The Court of Appeal of Rome on June 3, 2009 decides (no. 2327) that: *«Article 1, Law no. 184 of 1983, sanctions the child's right to grow up within the family of origin, giving priority to the child, protecting him/her and guaranteeing his/her effective fulfilment regardless of gender, language, religion, even in the presence of parental indigence, through the provision of help and support. In this sense, in fact, even in situations of extreme difficulty of the family of origin, the law guarantees the most balanced development of the child through the recovery of the family itself, with the activation of support measures by the social structures, with the aim of allowing the child to be raised, educated and cared within his or her family environment. In the system thus delineated, the institution of adoption, as preceded by the declaration of abandonment, constitutes an extreme remedy that can only be reached after a particularly rigorous assessment of the child's situation (In the light of the above, it does not appear that the child's right to be brought up and educated by his or her parents is compromised, given that the child is not deprived of the affection and closeness of his or her parents, or lacking in material and moral care, but has limited parental capacity, which can certainly be improved and positively developed through a strong support project).».*

Figure 5 – *Highlights of the ministry's guidelines*

Care in residential services for minors (a)	Family fostering (b)	Children and families in vulnerable situations (c)
102. Among children's rights an important place is taken by the right of every child to grow up and be educated within his or her own family, according to art. 1 of Law 184/1983, as amended by Law 149/2001.	**110**. Family fostering is generally a short- to medium-term intervention mainly aimed at families experiencing particular difficulties in the care and education of their children.	**020**. The complexity and often fragmented nature of the intervention of the different actors involved in the work of accompanying children and families [...] requires clear national guidelines that can guarantee: fair treatment and equal implementation of rights to children and families living in different territorial contexts [...].
102. Those responsible for the care and protection of the child ensure that efforts are made to have the child stay with or return to his or her parents or, where appropriate, to other family members.	**110**. The different types of family fostering are placed on a continuum and still refer to the same purpose of reuniting the child with his or her family. **Recommendation 110.1**. Consider family fostering, in its different forms, a privileged tool to prevent the removal of a child from its family.	**030**. This set of norms, together with [...] the Council of Europe's call for public policies to create the conditions to enable positive and responsible parenting, call for taking into account the need for every child to grow up in a caring and supportive environment, actively counteracting the emergence of situations that lead to the separation of children from the family by accompanying vulnerable parenting and the consequent articulation between the sphere of protection of 'minors' and that of parenting support.
102. The care pathway ensures that parents, relatives and adults of reference, when not in conflict with the need for guardianship, are provided with all appropriate forms of maintenance and development of affective and relational ties with the child in hetero-familial care.	**Recommendation 113.1**. Acknowledging the pain and fatigue of the parents and family nucleus of the child in foster care due to separation from their child and having to turn to and rely on third parties (voluntarily or judicially).	

Source: (a) See. ML, 2012, pag. 8; (b) ML, 2013, pagg 11, 15; (c) ML, 2017, pagg. 9, 11, 12.

9. Final remarks

Critical issues emerge with regard to both sources and the availability data. Significant territorial differences are observed that also depend on the regional competence of intervention policies and, in many contexts, there are contrasts with ministerial guidelines that seem to suggest a failure of public policies. Thanks to the non-profit institution Telefono Arcobaleno, it was possible to learning more from real cases. In the first case, with an *ex-ante* assessment, all children and family rights

are disregarded. In the second case, with an *in itinere* assessment and thanks to the strong intervention of systemic support to the family unit, all the rights of the minors and the family are preserved. Deprivation and precarious economic conditions, in both cases were at the root of other family fragilities, however, in the second case, the temporary joint custody of the public and private social sector leads to an amplification of the potential of family support services.

From a normative point of view: law, judgments and ministerial guidelines do not seem to be respected. There seems to be no gradualness in the funding, use and prescription of the available instruments. Family fostering and residential services should be the last resort, allowed after having adopted all the other possible measures to support the nucleus, otherwise, the solutions can make the problems worse. This is because, due to the cobra effect, incentives that are not *"neutral"* or not gradual can backfire: good intentions and perverse outcomes.

References

DUPUIS, S. 2020. *Duplessis Orphans*. The Canadian Encyclopedia. https://www.thecanadianencyclopedia.ca/en/article/duplessis-orphans.

SNA 1993. European Communities, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations and World Bank (1993) System of National Accounts 1993. United Nations. Brussels/Luxembourg, New York, Paris, Washington, D.C. https://unstats.un.org/unsd/nationalaccount/docs/1993sna.pdf

SNA 2008. European Communities, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations and World Bank (2009) System of National Accounts 2008. United Nations Sales No. E.08.XVII.29. New York. https://unstats.un.org/unsd/nationalaccount/docs/SNA2008.pdf

ML (MINISTERO DEL LAVORO E DELLE POLITICHE SOCIALI) 2012. *Linee di indirizzo per l'accoglienza nei servizi residenziali per minorenni*.

ML 2013. *Linee di indirizzo per l'affidamento familiare*.

ML 2017. *L'intervento con bambini e famiglie in situazione di vulnerabilità*.

ML 2018. *Affidamenti familiari e collocamenti in comunità al 31/12/2016*. Q. 42.

ML 2020. *Bambini e ragazzi in affidamento familiare e nei servizi residenziali per minorenni*. Q. 46.

ML 2021. *Bambini e ragazzi in affidamento familiare e nei servizi residenziali per minorenni*. Q. 49.

SIEBERT, H. 2002. *Der Kobra- Effekt*. Wie man Irrwege der Wirtschaftspolitik vermeidet, Deutsche Verlags-Anstalt.

STAME, N. 2000. *L'esperienza della valutazione.* Edizioni Seam, Roma, pp. 165.

THE PRESCOTT COURIER 1993. *Orphans sue Catholic orders over mistreatment*. May   21,   1993.   10A.   https://news.google.com/newspapers? id=lT9TAAAAIBAJ&sjid=A4UDAAAAIBAJ&hl=it&pg=6732%2C2759782

UNITED NATIONS 2003. *Handbook on Non-profit Institutions in the System of National Accounts*, Studies in Methods, Series F., No. 91, New York.

UNITED NATIONS 2018. *Satellite Account on Nonprofit and Related Institutions and Volunteer Work*, New York.

VANN, M. G. 2003. *Of Rats, Rice, and Race: The Great Hanoi Rat Massacre, an Episode in French Colonial History*. French Colonial History. 4: 191–203.

ZANCANER, L. 2019. *Minori e comunità, il giro d'affari dietro gli affidi in Italia*. Il sole 24 ore 20.08.2019. https://alleyoop.ilsole24ore.com/2019/08/20/affidi-minori/?refresh_ce=1

SUMMARY

Vulnerability can manifest itself in society through multiple dimensions that are not always only economic. Poverty, marginality or socio-economic vulnerability if not adequately countered through careful policies can be the determinants of deviant systemic behaviour. The aim of the work concerns the study of a particular population, that of minors placed outside their families of origin and received in foster families and residential services. The aspects of interest concern: i. The analysis of existing official sources; ii. The analysis of data with methods capable of bringing out territorial gaps and marginalities; iii. The normative analysis, with reference to ministerial guidelines. Critical issues emerge with regard to sources, both because of the endemic nature of the phenomenon and because of the availability of data that is mostly administrative in nature. With regard to the phenomenon, however, important territorial gaps are observed that also depend on the regional competence of intervention policies and, in many contexts, there are contrasts with ministerial guidelines that seem to suggest a failure of public policies. Are we facing to the *cobra effect*?

_____

Monica AIROLDI, Telefono Arcobaleno, monica.airoldi@gmail.com
Arianna CARRA, Istat North-West Territorial Office, carra@istat.it
Daniela CORSO, Telefono Arcobaleno, daniela.corso@telefonoarcobaleno.org
Stefania DELLA QUEVA, Istat Structural Statistics Office, dellaqueva@istat.it
Sabrina STOPPIELLO, Istat Structural Statistics Office, sabrina.stoppiello@istat.it
Flavio VERRECCHIA, Istat North-West Territorial Office, verrecchia@istat.it

FRAGILITIES AND ADVANTAGES OF COASTAL AREAS IN THE MEDITERRANEAN BASIN[1]

Anna Pia M. Mirto, Daniela Vacca, Enrico Olla, Francesca Abate

1. Introduction and policy framework

This research addresses a multisource analysis related to the responses of systems for the sustainable protection of the seas and resources, and it is also a contribution to the reading of sustainable development goals for United Nations 2030 Agenda, which aims to pursue the objectives of "Blue Growth" in the Mediterranean areas and to meet the challenge of climate change within the European Union (European Commission, 2021a).

The general framework in which this contribution rises, introduces a range of EU policies that address the interlinked thematic shared guidelines to preserve ocean health and safeguard marine ecosystems (see Table 1, Eurostat, 2022).

Marine Strategy Framework Directive (MSFD) that aims to ensure marine waters achieving good environmental status by being ecologically clean, healthy, and productive, has pushed for a better understanding of the pressures and impacts of human activities on the sea, and their implications for marine biodiversity, habitat and ecosystems. EU Bathing Directive lays down provisions for monitoring and classifying bathing water quality at designated sites.

EU Biodiversity Strategy for 2030 aims to enhance the protection of marine ecosystems with the objective of achieving good environmental status. Zero Pollution Action Plan for Air, Water and Soil sets out key actions to improve water quality by reducing emissions of waste, plastic litter at sea and microplastics (European Commission, 2021b).

Finally, the EU Strategy on adaptation to climate change aims to stop ocean acidification and encourages nature-based solutions to sustain Europe's seas.

In short, the EU is committed to improve water quality in marine waters and coastal areas in the sea basins around the EU, especially the Mediterranean Sea,

---

[1] The paper has been jointly written by all the authors but § 1, 2.2, 5, 6 and 7 can be attributed to A. P. M. Mirto, § 2.1 to E. Olla, § 3 and 4 to D. Vacca, while § 8 to all the authors. Italian maps in ArcGis have been created by E. Olla, European maps by L. D'Alessandro and F. P. Rizzo.

through a range of land-based and marine-based policies monitored by a defined set of indicators.

After a geo-mapping descriptive analysis, a statistical multivariate study has been applied to compare coastal and non-coastal areas classifying by different indicators the main components. In the end, some composite indicators have been identified, first for Italian municipalities and then for European regions, according to the main thematic domains: landscape, mobility, and demography.

Table 1 – *Main EU policy regulations about sea safeguard and soil protection.*

EU Legal Act	Theme	Main Objectives	References
MSFD	Marine water	Pressure of human activities on the sea and preservation of marine biodiversity and ecosystems.	Directive 2008/56/EC
Bathing Water Directive	Bathing Water quality	Classification of water quality	Directive 2006/7/EC
Biodiversity Strategy	Marine ecosystem	Protection of marine ecosystems	COM (2020), 380 final
Zero Pollution Action Plan	Water quality	Reducing emission of waste	COM (2021), 400 final
International Ocean Governance Agenda	Ocean sustainability	Providing a platform to discuss solution on the sea sustainability	JOIN (2016), 49 final
Strategy on adaptation to climate change	European seas	Stop ocean acidification and encourage nature-based solutions	COM (2021), 80 final

Source: European Commission - Marine Environment website.

2. Sources and methods

The methodological process underlying the project deals with the identification of coastal and non-coastal areas within shared classifications and the selection of relevant thematic indicators on a national and European levels (see Figure 1, Istat, 2020).

Figure 1 – *Main methodological steps.*
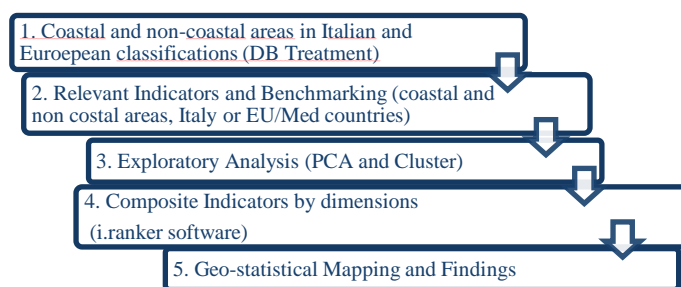
More in details geographical areas on European level have been classified according to the Nomenclature of Territorial Units in 2016 and 2021. Finally, Tercet

EU 2017/2391 Regulation identifies classification about municipalities related to the distance away from the coast. The classification of coastal areas is defined as either the territories bordering the coastline or where more than half of the population living on the coastline or territories less than 50 kilometers from the sea.

2.1 Sources and methods at Italy level

The fragilities and advantages of the Italian coastal zones were analysed by a set of indicators that represent the relevant dimensions: landscape, mobility, and demography (Istat, 2022).

Data used for the construction of the indicators of the demographic, geographical and social context are extracted from Istat sources, while those relating to the environment and protection of the territory come from Ispra (see Table 2).

Table 2 – *Relevant Italy indicators by domains.*

Domain/Indicator	Definition	Time
1. LANDSCAPE – Sources: Istat (1.3) and Ispra (1.1, 1.2, 1.4)		
1.1 Land Consumption (%)	% Land use	2020
1.2 Urban Waste per Inhabitant (kg)	(Urban waste / population) * 100	2020
1.3 Water Consumption per Inhabitant (L)	Water supplied in a day per inhabitant	2018
1.4 Separate Waste (%)	Separate waste / Urban waste	2020
2. MOBILITY – Source: Istat		
2.1 Tourist Accomodation Establishments per km^2	Number of establishments / Surface	2020
2.2 Nights Spent per Inhabitant	Number of nights spent / Population	2020
2.3 Composite Index of Tourist Density	Classification of municipalities according to their tourist vocation	2019
3. DEMOGRAPHY – Source: Istat		
3.1 Change in Population (%)	(Pop. 2021 – Pop. 2012) / Pop. 2012 *100	2012, 2021
3.2 Population Density	Population / Total Surface	2021
3.3 Aging Index	Ratio between population over 65 years and the population under 15 years * 100	2021

Over the last ten years, the number of Italian municipalities has decreased by over a hundred units (see Table 3) therefore the 2012 data had to be adjusted to be compared with 2021 data, by merging population, surface, and other geographical classifications[2] related to current municipality unions to obtain the *Change in Population* indicator.

---

[2] Istat elaborates classifications of Italian municipalities that are based on geomorphological characters or urban settlements, measured for statistical purposes only. A series of attributes are therefore assigned to municipalities, corresponding to the following physical and/or anthropological characteristics: coastlines, altitude zone, altitude of the main town, municipal area (km^2), urbanisation degree, coastal areas to which are added information related to area and population (legal and resident).

Another significant data processing was used for the *Nights Spent per Inhabitant,* in which some figures have been obscured to protect statistical confidentiality. In these cases, missing data were extrapolated from aggregated ones of all other municipalities within the same province.

Table 3 – *Population changes 2012-2021.*

	Italy			Coastal				Non-Coastal			
Year	Population	Mun.	% Pop. Change	Population	Nr	% Pop	% Pop. Change	Population	Nr	% Pop	% Pop. Change
2012	59.394.207	8092		20.295.724	1170	34,2		39.098.483	6.922	65,8	
2013	59.685.227	8082	0,49	20.364.115	1170	34,1	0,34	39.321.112	6.912	65,9	0,57
2014	60.782.668	8071	1,84	20.958.442	1169	34,5	2,92	39.824.226	6.902	65,5	1,28
2015	60.795.612	8048	0,02	20.971.579	1169	34,5	0,06	39.824.033	6.879	65,5	0,00
2016	60.665.551	8003	-0,21	20.923.670	1169	34,5	-0,23	39.741.881	6.834	65,5	-0,21
2017	60.589.445	7983	-0,13	20.903.428	1169	34,5	-0,10	39.686.017	6.814	65,5	-0,14
2018	60.483.973	7960	-0,17	20.856.229	1168	34,5	-0,23	39.627.744	6.792	65,5	-0,15
2019	59.816.673	7926	-1,10	20.496.248	1166	34,3	-1,73	39.320.425	6.760	65,7	-0,78
2020	59.641.488	7903	-0,29	20.411.913	1165	34,2	-0,41	39.229.575	6.738	65,8	-0,23
2021	59.236.213	7903	-0,68	20.258.799	1165	34,2	-0,75	38.977.414	6.738	65,8	-0,64

The last significant data elaboration regards *Urban Waste* indicators. The rubbish collection service often manages urban waste of many municipalities organized in unions and Ispra collected the total data of those aggregations (Ispra, 2021). To represent and compare these data for all single municipalities, the association values have been recalculated by relating the total measure to the individual population and area data.

2.2 Sources and methods at EU level

The primary source of European information is the Eurostat Data Browser that provides data at NUTS 2 level for the areas of the European Union countries and those washed by the Mediterranean Sea (Mirto and Ticca, 2017).

Data treatment in the European databases has been quite impressive, managing and imputing missing data as well as considering outliers for specific countries and time periods, especially concentrated in certain thematic areas. The selected relevant indicators were classified by three components: landscape, mobility, and demography (see Table 4*).*

Table 4 – *Relevant EU indicators by domains.*

Domain/Indicator	Definition	Territory - Time
1. LANDSCAPE – Source: Eurostat Data Browser and JRC EC (1.4 and 1.5)		
1.1 Artificial Land (%)	Areas characterized by an artificial and often impervious cover of constructions and pavement / Total surface	NUTS 2 – 2018 and 2012
1.2 Soil erosion (%)	% Estimated soil erosion by water	NUTS 2 - 2016
1.3 Land Use with heavy impact (%)	% Land use with heavy environmental impact	NUTS 2 - 2018
1.4 Heating Day degrees (absolute values and % var. 2021/2012)	Severity of the cold at a specific time, taking into consideration outdoor temperature and average room temperature	NUTS 3 – 2021 and 2012
1.5 Cooling Day degrees (absolute values and % var. 2021/2012)	Severity of the heat at a specific time, taking into consideration outdoor temperature and average room temperature	NUTS 3 – 2021 and 2012
2. MOBILITY – Source: Eurostat Data Browser		
2.1 Establishment per Km^2	Number of establishments / total surface	NUTS 3 – 2020, 2019 and 2012
2.2 Nights spent per inhabitant	(Number of nights spent / population) * 1.000	NUTS 2 – 2020, 2019 and 2012
2.3 Net occupancy rate of hotel bed-places	Total number of overnight stays divided by the number of bed places on offer (excluding extra beds) and the number of days when the bed places are available for use (net of seasonal closures and other temporary closures) * 100	NUTS 2 - 2019
2.3 Passenger Sea transport per inhabitant	(Number of passenger sea transport / population) * 1.000	NUTS 2 - 2019
3. DEMOGRAPHY – Source Eurostat Data Browser		
3.1 Life expectancy at birth – male, female and total	Number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life	NUTS 2 - 2020
3.2 Population Density	Population / Total Surface	NUTS 3 - 2020
3.3 Ageing index	Ratio between population over 65 years and the population under 15 years * 100	NUTS 2 -2021

3. Main findings in Italian coastal and non-coastal municipalities

In Italy, as of January 1st, 2021, the coastal municipalities are 1,165, about 15% of the total amount. There are five regions without coastal zones (Lombardy, Trentino Alto Adige, Piedmont, Valle d'Aosta, Umbria). The record of the regional incidence of coastal municipalities belongs to Liguria with just under 60%, followed by Sicily, Puglia, and Calabria which have about 45% of their municipalities classified as coastal. The part of the population that lives in these areas has a lower aging rate than the national and non-coastal areas' average. There are 180 people aged sixty-five and over every 100 0-14 years old children against 183 Italians and 184 of non-coastal areas.

Analyzing the same year, the Italian resident population is 5,926,213, down from the year 2012 by 1.47% (see Figure 2). In ten years, Italy has lost about 871 thousand

people. In coastal areas the same trend is observed at national level, although it shows a lower intensity (-1.17%). On the other hand, not coastal areas go over the national average data with a variation of -1.63%.

Figure 2 – *Mapping % Change in Population 2021/2012 and Population Density 2021 by Italian municipalities.*
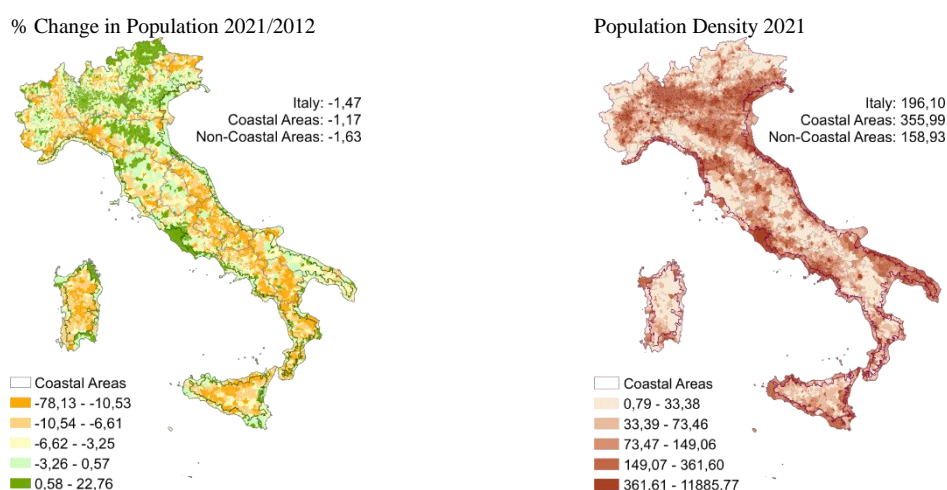
Anthropic pressure, measured with *Population Density*, is much higher in coastal areas, where it reaches 356 inhabitants for 1 km vs. 159 in non-coastal areas.

Coastal areas are also very attractive from a touristic point of view. During 2020, the nights spent at tourist accommodation per inhabitant are 5.36 in coastal areas, more than double the value of non-coastal areas (2.45, Figure 3). However, the level of tourist attractiveness in 2020 is affected by the reduction of mobility due to the restrictions of the pandemic period. In fact, in 2019, the value of this indicator was 7.30 at the national level, 11.26 for coastal areas and 5.07 for non-coastal areas.

9 out of 10 municipalities with the highest tourist flow per inhabitant (values above 298) belong to the non-coastal areas of Trentino-Alto Adige.

Also, tourism impact, in terms of accommodation establishment per km^2, is higher in coastal areas, where a rate of 2.11 was measured in 2020 vs. 0.43 in non-coastal municipalities. Among the top ten municipalities with a higher density of accommodation, (values higher than 47.6), six are in the coastal areas of the Adriatic coast (Jesolo, San Michele al Tagliamento, Lignano Sabbiadoro, Gabicce Mare, Cattolica, Riccione) and two in the Amalfi Coast.

Figure 3 – *Mapping main results in Italian coastal and non-coastal areas at municipal level – Mobility.*

Night Spent at Tourism Accommodation per inhabitant 2020

Tourism Accommodation Establishments per km2 2020

Composite Index of Tourist Density 2019
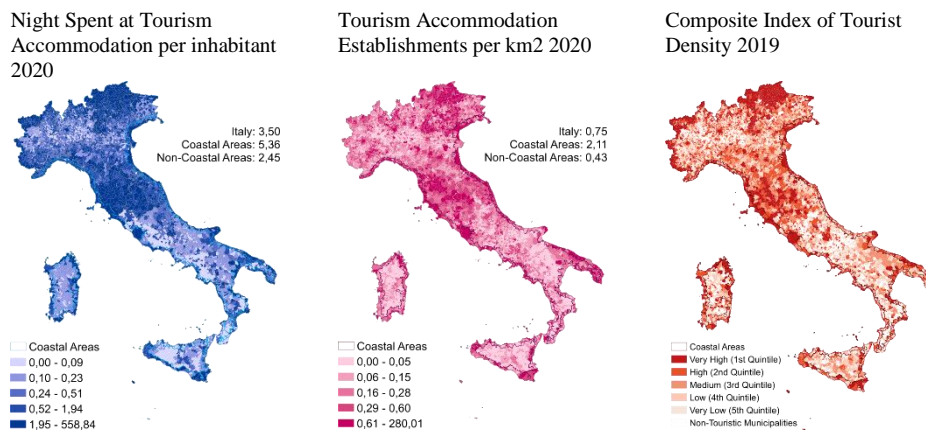
Figure 4 – *Mapping main results in Italian coastal and non-coastal areas at municipal level – Landscape.*

Water Consumption per inhabitant 2018

% Land Consumption 2020
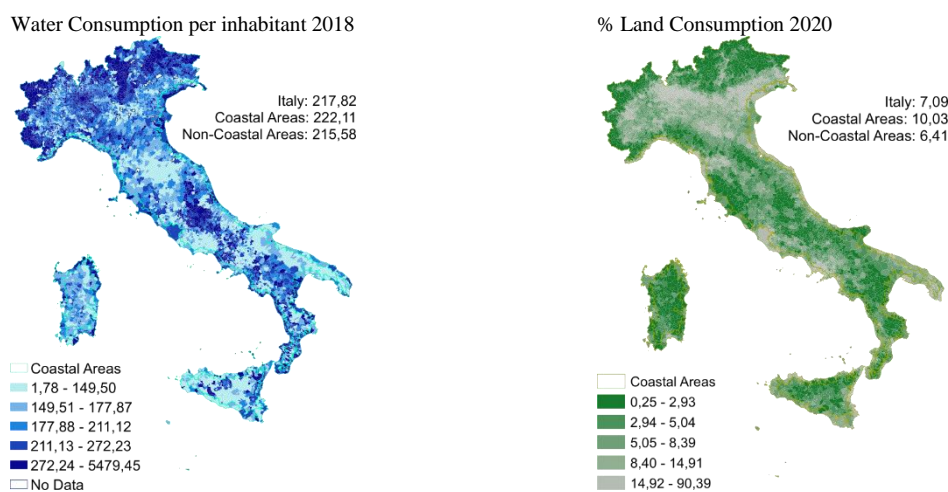
Another key factor is the condition of the municipal landscape and the natural resources' consumption. In coastal areas there is a greater production of municipal waste: 51.8 per 100 inhabitants against 48.9 in Italy and 46.9 in coastal areas.

As the Figure 4 shows, water consumption is also higher at 222 liters per inhabitant (218 in Italy and 216 in non-coastal). The same trend is observed through

the analysis of land consumption, which in coastal areas is 10% and in non-coastal areas is 6%.

Figure 5 – *Findings in Principal Component Analysis and Cluster for Italian municipalities.*

Cluster	Characters	Main Municipalities	% Costal Areas
CL1	Population criticality, low population density and low land use	Trapani, Savona	12,0
CL2	Propensity to population development and high land consumption	Messina, Parma, Taranto	16,5
CL3	Medium and large urban centres with high demographic attractiveness, high urban density and considerable tourist attraction	Roma, Milano, Venezia, Napoli, Bari, Palermo	26,3
CL4	Very small inner areas with a tendency to aging and population loss	Castelcivita, Montegiordano, Oriolo	3,7
CL5	Small towns located in coastal and mountain areas with good tourist attractiveness and high water consumption	Sorrento, Cattolica, Riccione, Caorle, Jesolo	22,1
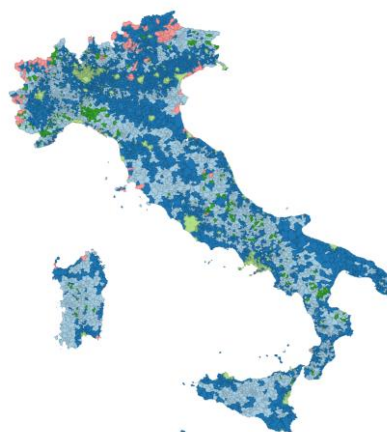
4. PCA and Cluster at Italian level

Multivariate analysis techniques[3] have been used to draw a synthetic profile of municipalities, representative of descriptive dimensions.

The municipal indicators were subjected to a preventive Principal Component Analysis (PCA) with the aim of reducing the size of the initial set of data to better grasp the information structure underlying the data. Three components were selected from PCA, with a cumulative proportion of variance of 0.5591 and a ratio of the total sum of squares of 0.5779. Figure 5 describes the main results of this analysis.

---

[3] Multivariate analysis was carried out with the Geoda software. For Principal Components (PCA) the SVD Single-Value Decomposition method was used, and the variables were standardized with the z-score method. The non-hierarchical (NHC) k-mean method was used for cluster analysis.

Figure 6 – *Mapping in Heating and Cooling Degree Days for NUTS 2 regions.*
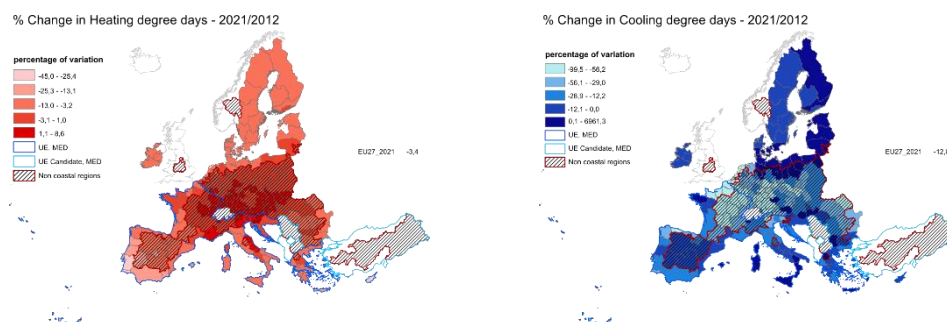
5. Main findings in EU coastal and non-coastal regions

The Mediterranean area is a climate hotspot where temperatures have already recently increased by 1.5 C°, while the world average increase is 1.1 C° (see Figure 6). The warming effect in the Mediterranean is more intense now than in most of the world, with increasing risks associated to climate change (SDSN Mediterranean, 2020). Between 2021 and 2012 *Heating needs* have decreased less in Med countries while *Cooling needs* have increased more in north European countries over the time.

To analyse this effect and more in general the relation between human pressure and settlements in the different coastal and non-coastal areas, a specific analysis has been carried out by using principal component analysis and afterward a specific software "i.ranker"[4] to define some composite indicators.
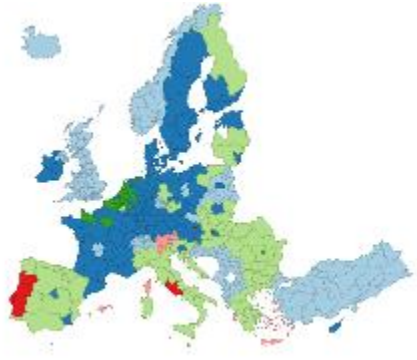
6. PCA and Cluster at EU level

Three components have been selected by Principal Component Analysis and the cumulative proportion of variance was 0.6864, while the ratio of between to total sum of squares was 0.7649. The main findings have been described in Figure 7.

---

[4] i.ranker is a software system that allows the calculation of synthetic indicators through the analysis and comparative evaluation of the main methods of statistical synthesis of elementary indicators available in the literature, https://i.ranker.istat.it/.

Figure 7 – *Findings in Principal Component Analysis and Cluster for NUTS 2 regions.*

Cluster	Characters	Main regions
Cl light blue	Missing data	
Cl dark blue	Positive demographic change and moderate geo-climatic advantage	France, Germany, Ireland
Cl light green	Negative demographic change and good geo-climatic advantage	Italy, Spain, Slovenia, Romania
Cl dark green	High population density Urban areas with geo-climatic disadvantage	Paris, Budapest, Dusseldorf
Cl pink	High tourism density in low urbanized areas	Corsica, Baleares, Canaries
Cl red	High tourism density in highly urbanized areas	Lisbon, Lazio, Vienna

7. Composite indicators by domains at EU level

Ranker composite indicator software has been applied to identify three composite indicators for the different components: landscape, mobility, and demography (Mazziotta and Pareto, 2017). Therefore, according to Mazziotta-Pareto Index+ (in the positive variant) regions belonging to the groups characterised by dark red colours are those ones with a high geo-climatic advantage and localised especially in non-coastal areas. Moreover, according to the same index the regions with a high liveliness (dark green) are localised in the coasts.

Figure 8 – *Composite indicators by geo-climatic and tourism dimensions.*
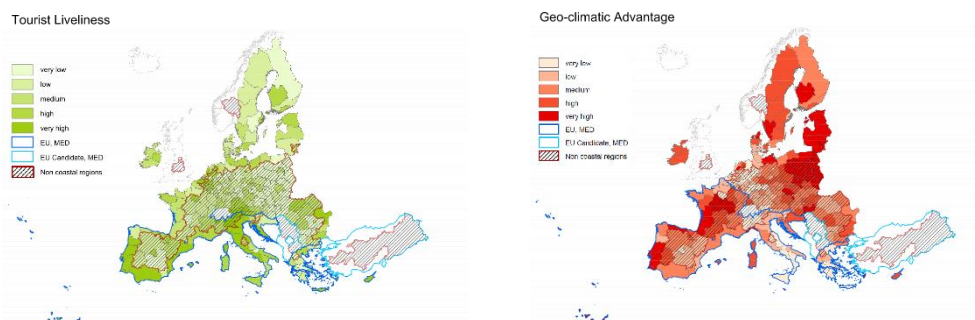
8. Final remarks

Soil strategy is strictly linked to European Green Deal midterm goals to achieve good ecological and chemical conditions in surface water, and good chemical and quantitative conditions in groundwater by 2017. Coordinating water and soil policies is essential to achieve soil and aquatic ecosystem health through better soil and water management (COM (2021) 699).

According to the multidimensional analysis the principal findings are the following:

- Demographical dimension has been greatly influenced by the level of population as well as their health condition, but Italy shows different tendency in comparison to the European Union overall.
- Mobility dimension greatly related to the tourism flows has measured the anthropic impact in coastal areas at national level as well as European one.
- Geo-climatic indicators have shown an advantage especially in non-coastal areas belonging to the EU.

References

EUROSTAT. 2022. *Sustainable development in the European Union. Monitoring report on progress towards the SDGs in an EU context*.Luxembourg.

EUROPEAN COMMISSION. 2021a. *The EU Blue Economy Report 2021*. European Union.

EUROPEAN COMMISSION. 2021b. Comunicazione della Commissione al Parlamento europeo, al Consiglio, al Comitato Economico e Sociale Europeo e al Comitato delle Regioni. *Strategia dell'UE per il suolo per il 2030. Suoli sani a vantaggio delle persone, degli alimenti, della natura e del clima*. COM (2021) 699.

ISPRA. 2021. *Libro bianco sulla gestione sostenibile del suolo*. Progetto Soil4life.

ISTAT. 2022. *Attività antropiche e salute delle coste. Indicatori territoriali di rischio e sostenibilità per le aree costiere e insulari in Italia e nell' Unione Europea*. Letture statistiche - Territori.

ISTAT. 2020. Rapporto sul territorio 2020. Ambiente, economia e società. Letture statistiche – Temi.

MAZZIOTTA M., PARETO A. 2017. Chapter 7 Synthesis of Indicators: The Composite Indicators Approach in MAGGINO F. (ed.), *Complexity in Society: From Indicators Construction to their Synthesis*, Social Indicators Research Series 70, DOI 10.1007/978-3-319-60595-1_7. Springer International Publishing AG 2017.

MIRTO, A. P. M., TICCA P.G. 2017. "UE Coast - Linee guida e metodi. Visualizzazione e analisi di dati geografici dei paesi appartenenti all'Unione Europea che si affacciano sul mare".*Portale Gistat. Il sistema informativo geografico dell'Istat*, marzo. Roma: Istat.

SDSN MEDITERRANEAN. 2020. *Sustainable development in the Mediterranean. Report 2020. Transformations to achieve SDGs*. September.

SUMMARY

To pursue the goals of Blue Growth and meet the challenge of climate change, the multisource analysis related to the responses of systems for the sustainable protection of the seas and resources offers here a contribution to the reading of the objectives for sustainable development of the 2030 Agenda of the United Nations.

The article explores the issues of sustainability, including a set of indicators useful for assessing the human impact and land consumption of coastal and coastal regions in the Mediterranean basin and in the EU regions. A focus on the municipal scale deepens the same themes at the national level.

The conceptual picture of the anthropogenic impact on the environment of the coastal and non-coastal areas of the EU and Mediterranean countries may derive - as is well known - from demographic factors, tourist pressure, the presence of major commercial ports, the pressure of municipal waste per capita, sources of water supply and volumes of distribution networks in coastal areas as well as an increased risk of land cover transformation that inexorably impacts land consumption and the conservation of natural resources and landscape of the territories.

The development perspectives of this paper are oriented towards finding an appropriate synthesis method for assessing the impact of the anthropic action on coastal and coastal areas, with reference to the evaluation of the different demographic, environmental and natural dimensions that are offered by the territorial analysis.

_____

Anna Pia M. MIRTO, Istat, mirto@istat.it
Daniela VACCA, Istat, vacca@istat.it
Enrico OLLA, Istat, enrico.olla@istat.it
Francesca ABATE, Istat, abate@istat.it

DISCOVERING INNER RURAL AREAS, PERSPECTIVES AND LIMITS OF CONTINUOUS CENSUSES[1]

Antonella Bianchino, Daniela Fusco, Paola Giordano

1. Introduction

Italy's National Strategy for Inner Areas (SNAI) is an innovative policy for development and territorial cohesion to counteract marginalization and demographic decline within Inner Areas (IA) throughout the Country. The identification of the IA starts from a polycentric reading of the Italian territory, characterized by a network of municipalities or aggregations of municipalities (service offering centers) around which gravitate areas characterized by different levels of spatial marginality (Cohesion Policy Department, DPS, 2021).

IA are fragile territories and the main hypothesis that identifies their nature is the "distance" from essential services. IA, in this conception, is not necessarily synonymous of "weak area". Rather, it identifies a characteristic of these areas, related to the considered aspects (schools, health and rail transport services). While the distance from basic services represents a limit for the territories, their marginality can become a strong point, an important environmental value that could be exploited for economic purposes. In the IA, the agricultural, pastoral and forestry sectors play a central role as opportunities for economic growth and for the value of care and environmental prevention (Lucatelli and Storti, 2019). For example, agricultural soil management is essential in areas with high levels of landslide risk and hydrogeological disruption; pastoralism contributes to the vitality of mountain giving a contribution to maintaining biodiversity and fighting soil degradation.

In this context, the grown of IA is connected to the agricultural multifunctionality, in terms of non-agricultural activities and diversification of production, with the aim of diversifying income and avoiding risk factors. The complexity of multifunctionality determines a considerable difficulty of measurement.

---

[1] Authors contributions: Antonella Bianchino the revision of the whole article; Daniela Fusco paragraphs 1, 2, 4, appendix table 2 and References; Paola Giordano paragraph 3, related subparagraphs, appendix table 1 and Summary.

The aim of the work is to represent the complexity of multifunctionality and synthesize, at a territorial level, the farms resilience respect to economic changes.

The study identifies useful indicators for the evaluation of these phenomena by exploiting the opportunity given by continuous censuses to allow trend analysis and analyze the weight of farms on tourism potential. The result provides a tool for monitoring IA with a view to assessment of the resilience of the territories.

2. Agriculture and rural area development, Inner Areas and Rural Areas with development problems

Agricultural activities are very fragile and fragmented in IA. Farms surviving needs innovation and reorganization of the sector, based on cooperative models and shared business projects. Besides, it is functional to the construction of an integrated and organized offer of high-typical goods and services (specialties and integrated specialties) in synergy with tourism (Musotti, 2018).

In this context, the link between SNAI and rural development policies (National Strategy Plan for Rural areas -NSP) plays a key role. NSP is co-financed by the European Agricultural Fund for Rural Development (EAFRD) referred to in Reg. (EU) no. 1305/2013. Itis the tool through which the Ministry of Agricultural, Food and Forestry Policies aims to support and develop the potential of rural areas throughout the Italian territory. The EAFRD ensures the 17.7 per cent of the Strategies total financing at the national level, the 15 per cent of South Italy Strategies and 40 per cent of the North of the country, which is added to the SNAI funds who insist on those areas.

The integration between EAFRD and SNAI did not take place according to a unitary approach, but it refers to very varied implementation methods depending on the contexts. The intervention models and the choice of measures depend on the differences in regional practices and on the different perceptions of the Administrations about the needs of these areas. The identification of rural areas for NSP (2014-2020), is based on criteria connected to demographic, altitude profile, and agricultural area aspects. Classification includes A - urban poles, B - rural areas with specialized intensive agriculture, C - intermediate rural areas, D - rural areas with comprehensive development problems. D - Areas include mainly rural mountain areas, predominantly rural hill areas (South Italy) and significantly rural mountain areas (South Italy) and they account for about 30% of municipalities. In this study, we have made a comparison between IA ad D-Areas: Figure 1 shows the IA coincident with D Areas. There are 1,327 municipalities which could receive funds both for the Inner Areas and for NSP (D- Areas) Strategies.

Figure 1 – *Geographical connection between SNAI and NSP (D-Areas).*
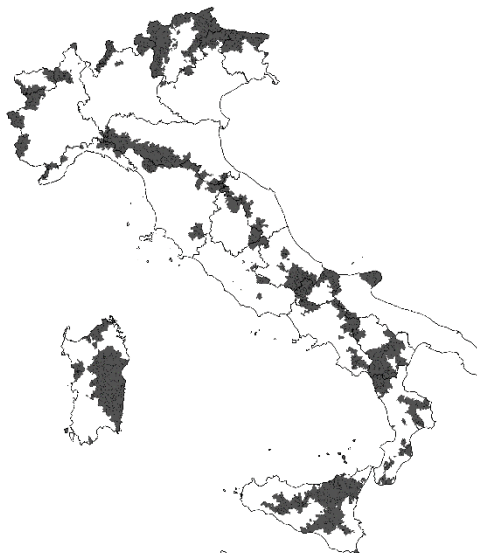
Source: Our elaboration on SNAI and NPS data.

3. Multifunctional agriculture: concepts and measurement

We can say that agriculture is always multifunctional because of its peculiarities, as all the implications that agricultural activity has had on society and the environment (Finocchio, 2008).

Multifunctionality is the ability of the primary sector to produce secondary goods and services of various kinds, together with the production of products for human and animal consumption. This term implies an innovation of the organization of the enterprise and the production techniques (Henke, 2004).

The economic and agrarian literature has shown that agricultural incomes are historically lower and unstable than non-agricultural sectors (Henke and Salvion, 2013). A first action to fight the reduction of income from agricultural activity is precisely the diversification: a more diversified production system can allow territories to more easily intercept competitive advantage factors useful to get out of the crisis and set local development strategies for the future (Capello and Nijkamp, 2009). The complexity of the definition of multifunctionality leads to a considerable difficulty in measuring the phenomenon. Following the OECD (OECD, 2008) indication for the composite indicator construction, the definition should give the

reader a clear sense of what is being measured by the indicator. It should refer to the theoretical framework, linking various sub-groups and the underlying indicators.

For the definition of multifunctionality it is possible to identify five conceptual areas or pillars: 1) landscape protection, 2) diversification of activities, 3) environment, 4) food quality and 5) protection of the territory (Greco *et al.,* 2013).

The estimation of a complex phenomenon as multifunctionality, with the use of a synthetic index, summarizes the concept at the highest levels, leaving little space to the analysis of the individual facets, but represents a photograph of the phenomenon, useful for the evaluation of agricultural *ex post* policies.

4. Measurement of agricultural resilience, the proposed model

Place-based development policies, by applying a combination of endogenous and exogenous forces and by requiring an appropriate multilevel governance to manage forecasting conflict between these forces, need for a main role of well-being indicators within an effective monitoring and evaluating system (Barca and McCann, 2011). The traditional framework – by now more than 10 years old – has no clear distinction and linkages between inputs, outputs, outcomes/results and impacts.

In our approach, we decided to consider context indicators, on one hand, and input and outcomes indicators on the other. Context indicators are used to assess the economic and social conditions of a given context (national, regional, sub-regional), by examining changes of variables through time or comparing data across space, to detect weaknesses and strengths, alert policy-makers and steer policy. Context indicators do not necessarily refer to any policy, and do not need to comply with any requisite of "responsiveness to policy". The policy financial resources are inputs aimed at producing planned outputs. The impact is the direct effect of policy action.

4.1 The sources used

In this study, the identification of indicators is based on two main data sources: Agricultural Census 2020 (Statistical source) and IACS (Administrative source). Both sources are under EU regulations.

Agricultural Census 2020. The 7th Agricultural Census is the last traditional census, with a mixed-mode technique for data collection ad involving 1.7 million of holdings. Since final data are not yet available, we based our analysis on published questionnaire and Regulations, to select core variables for building up our indicators. Questionnaire includes all mandatory variables under EU Relevant legislation. It includes Regulation (EU) 2018/1874 on the data to be provided for 2020, under Regulation (EU) 2018/1091 of the European Parliament and of the Council on

integrated farm statistics and repealing Regulations (EC) No 1166/2008 and Regulation (EU) 1337/2011, as regards the list of variables and their description. Regulation (EU) 2018/1091 provides both a framework for European statistics at the level of agricultural holdings and for the integration of information on their structure with information on production methods, rural development measures, agro-environmental aspects and other related information. Moreover, questionnaire includes variables collected for national needs.

IACS. IACS is the National Agency for agricultural payments, and it is the owner of administrative archives for subsidies given to agricultural holdings. This administrative source has been used in the Agricultural Census to reduce statistic burden for respondents, so we considered also this source, for some variables, for building up indicators. IACS is under Common Agriculture Policy (CAP) payment Regulations as:

- Regulation (EU) 1307/2013, establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy (i.e. payment for farmers observing agricultural practices beneficial for the climate and the environment, a voluntary payment for farmers in areas with natural constraints, a payment for young farmers commencing their agricultural activity).

- Regulation (EU) 1305/2013, on support for rural development by the European Agricultural Fund for Rural Development (EAFRD). This Regulation sets out the objectives to which rural development policy is to contribute and the relevant Union priorities for rural development. It outlines the strategic context for rural development policy and defines the measures to be adopted in order to implement rural development policy.

- Regulation (EU) 1306/2013, on the financing, management and monitoring of the common agricultural policy. This Regulation lays down the rules on the financing of expenditure under the Common Agricultural Policy (CAP), including expenditure on rural development.

4.2 Pillars and indicators proposed

In IA, the agricultural activities are very fragile and fragmented. Their survival depends on the construction of a new offer (diversification of activities) and of an integrated and organized high-typical goods and services (specialties and integrated specialties) offer, in synergy with tourism.

Agri-food production, although consisting of specialties, is in many cases a necessary, but not a sufficient development condition: so, it must be combined with other services, such as the entire cultural heritage of which a certain local system is provided, for the production of the so-called integrated specialties (Becattini and Zorini, 2003). Producing integrated specialties means producing, through the integration of more professions and more product areas, a cluster of goods and

services, rooted in a specific life experience, in a certain place, and identified through a combination of knowledge, specific values and institutions.

For these reasons, in this study we consider two pillars previously identified for the multifunctionality index (Greco *et al*., 2013): 1) Food quality and 2) Activity diversification. Besides, we added a third pillar: Rural Tourism support. Reasons for this choice are as follow.

Food quality: is the support for competitiveness, and consequently for the profitability of EU farmers. Consumer expectations meet the fulfilment of strict requirements in production standards, and the European community itself is pushing agricultural producers to ensure quality for the consumer (Appendix, Table 1a).

Activity diversification: it is the new agriculture trend, based on a different disarticulation of the productive factors and on the production of a more variegated output (Appendix, Table 1b).

Rural tourism support: tourism has the potential to contribute, directly or indirectly, to all the Agenda 2030 goals, mainly to the Goal 2-zero hunger. Tourism can spur agricultural productivity by promoting the production, use and sale of local production in tourist destinations and its full integration in the tourism value chain. In addition, agritourism, a growing tourism segment, can complement traditional agricultural activities. The resulting rise of income in local communities can lead to a more resilient agriculture while enhancing the value of the tourism experience (Appendix, Table 1c).

For Food Quality Pillar we chose indicators for typical productions and organic production, for livestock and cultivations. For Activity Diversification Pillar we dived Agritourism, Production of renewable energy and Contractual work from other gainful activities, because they are the main gainful activities for Italian farms. Finally, for Rural Tourism Support Pillar we considered some indicators used for Territory protection and Landscape protection. In addition, we considered young holders because they could enhance the sector competitiveness and the areas attractiveness. The EFA lands, considered in C.6 indicator, are Ecological Focus Area, area of land upon which you carry out agricultural practices that are beneficial for the climate and the environment. The main aim of an EFA is to improve biodiversity. Thanks' to the IACS archive data we can utilized some context indicators as input indicators. In fact, the administrative data gives the number of farms that benefit from CAP aids. Considering the objectives of the measures planned by European Regulations, other context indicators can be used as impact indicators. This proposed division is shown in Appendix Table 2a, 2b, and 2c.

5. Conclusion

The resilience of Inner Areas, to a certain point, depends on the agricultural sector. The construction of a new offer (diversification of activities) and the construction of an integrated and organized offer of high-typical goods and services (specialties and integrated specialties) in synergy with tourism is necessary for the sector development.

The Agricultural Census launched on January 7th (2021) represents the last decennial data collection: from 2023 onwards, the analysis will be conducted on an ongoing basis, through a complex system which integrates simplified, direct sample surveys and administrative data, so as to reflect the evolution of Italian rural reality. Thanks to the integration between administrative sources and sample surveys, the new censuses ensure the increase both in amount and in quality of data output, the reduction of the response burden for citizens and economic operators, and the decrease in overall costs. The innovations introduced will provide an up-to-date picture - an essential aspect to take into account when assessing and planning national and regional policies. The use of the Continuous Agricultural Census, combined with IACS data, will give the possibility of monitoring the development pillars chosen in this study (Food Quality, Activity Diversification and Rural Tourism Support) in terms of context, input and impact indicators.

The model proposed allows to calculate the indicators at a micro level with temporal continuity, ensuring the monitoring of inputs and outcomes at a geographical level useful for evaluating the farms resilience respect to economic changes in AI, although the actual unavailability of validated data doesn't permit the sharing of the results.

The limits of this approach are connected to the multisource processes. Particularly: specification error, discrepancies between the target statistical concept and the administrative concept used to measure it; frame and source errors, under coverage, over coverage, duplications and errors in the auxiliary variables are errors possible both in the frame and in the administrative source, time lag errors; selectivity error, units cancelled due to elaborations from the administrative data owner or are not transmitted for technical problems; model errors are those arising when a model is adopted in any stage of the statistical process, including in the estimation phase.

Appendix

Table 1 - Pillars and related context indicators.

Table 1a

Pillar	COD	Contest Indicators
	A.1	Holdings under support of Art. 16, Measure 3 (food quality) (Reg. No 1305/2013)/Total holdings
	A.2	Holdings with grapes for PDO wines/Total holdings with vineyard
	A.3	UAA with grapes for PDO wines/Total UAA
	A.4	Holdings with grapes for PGI wines/Total holdings with vineyard
	A.5	UAA with grapes for PGI wines/Total UAA
	A.6	Holdings with animal housing*/Total holdings with livestock
Food Quality	A.7	Average number of livestock in housing/Average number of livestock
	A.8	Holdings with Organic farming UAA/Total holdings with UAA
	A.9	Organic farming UAA/Total UAA
	A.10	Holdings under support of Art. 33, Measure 14 (Animal welfare) (Reg. No 1305/2013)/Total holdings with livestock
	A.11	Holdings with Organic farming livestock/Total holdings with livestock
	A.12	Heads of organic farming stock for every animal typology/Total heads of livestock for every animal typology

*Table 1a note: * Only for Dairy cows, Other bovine animals, Breeding sows, Other pigs, Laying hens.*

Table 1b

Pillar	COD	Contest Indicators
	B.1	Holdings with Production of renewable energy/Total holdings
	B.2	Holdings with other gainful activities (ref. Art. 19) (Reg. No 1305/2013), except points B.3 and B.4/Total holdings
	B.3	Holdings with Contractual work (using production means of the agricultural holding) /Total holdings
Activity Diversification	B.4	Holdings with Agritourisms/Total holdings
	B.5	Holdings participating in other environmental certification schemes (Reg. UE 1307/2013 Art. 43 point a)/Holdings with arable lands
	B.6	Arable land UAA according to Art. 43 scheme/Total UAA

Table 1c

Pillar	COD	Contest Indicators
	C.1	Holdings under support of Art. 21, Measures 8.1-8.5 (Reg. No 1305/2013) (Investments in forest area development and improvement of the viability of forests)/Total holdings
	C.2	Holdings with Wooded area/Total holdings
	C.3	Total Wooded area/Total area
	C.4	Holdings with Short rotation coppices /Total holdings
	C.5	Short rotation coppices area/Total area
	C.6	Holdings with EFA/Total holdings
	C.7	Holdings with Permanent grassland no longer used for production purposes and eligible for the payments/Total holdings with UAA
Rural Tourism Support	C.8	Permanent grassland no longer used for production purposes and eligible for the payments/Total UAA
	C.9	Permanent crops area/Total UAA
	C.10	Holdings with Fallow land/Total holdings with UAA
	C.11	Fallow land area (Reg. No 1306/2013)/Total UAA
	C.12	Holding under support of Art. 19 Measures 6.1 and 6.3 (Reg. 1305/2013) and Art. 50 (Reg. 1307/2013) (Business start-up support for young farmers)/Total holdings
	C.13	Number of holders with no more than 40 years of age/Total number of holders

Table 2 - Input and impact indicators for Food Quality pillar

Table 2a

Pillar	Input COD	Input indicators	COD	Outcome Indicators
	I.1	Holdings under support of Art. 16, Measure 3 (food quality) /Total holdings	A.2	Holdings with grapes for PDO wines/Total holdings with vineyard
			A.3	UAA with grapes for PDO wines/Total UAA
			A.4	Holdings with grapes for PGI wines/Total holdings with vineyard
			A.5	UAA with grapes for PGI wines/Total UAA
Food Quality	I.2	Holdings under support of Art. 29, Measure 11 (Organic farming) /Total holdings	A.8	Holdings with Organic farming UAA/Total holdings with UAA
			A.9	Organic farming UAA/Total UAA
	I.3	Holdings under support of Art. 33, Measure 14 (Animal welfare) /Total holdings with livestock	A.11	Holdings with Organic farming livestock/Total holdings with livestock

			A.12	Heads of organic farming stock for every animal typology/Total heads of livestock for every animal typology

Table 2b

Pillar	Input COD	Input indicators	COD	Outcome Indicators
	I.4	Holdings under support of Art. 19, Measures 6.2 and 6.4 (non-agricultural activities in rural areas)/Total holdings	B.1	Holdings with Production of renewable energy/Total holdings
			B.2	Holdings with other gainful activities (ref. Art. 19), except points B.3 and B.4/Total holdings
			B.3	Holdings with Contractual work (using production means of the agricultural holding)/Total holdings
Activity Diversification			B.4	Holdings with Agritourisms/Total holdings
	I.5	Holdings participating in other environmental certification schemes (Reg. UE 1307/2013 Art. 43 point a)/Holdings with arable lands	B.5	Holdings with arable land according to Art. 43 scheme/Total holdings
			B.6	Arable land UAA according to Art. 43 scheme/Total UAA

Table 2c

Pillar	Input COD	Input indicators	COD	Outcome Indicators
	I.6	Holdings under support of Art. 21, Measures 8.1-8.5 (Investments in forest area development and improvement of the viability of forests)/Total holdings	C.2	Holdings with Wooded area/Total holdings
		Holdings with Wooded area/Total holdings	C.3	Total Wooded area/Total area
			C.4	Holdings with Short rotation coppices /Total holdings
			C.5	Short rotation coppices area/Total area
Rural Tourism Support	I.7	Holdings participating in other environmental certification schemes (Reg. UE 1307/2013 Art. 43 points b and c)/Total holdings	C.6	Holdigs with efa/Total holdings
			C.7	Holdings with Permanent grassland no longer used for production purposes and eligible for the payments/Total holdings with UAA
			C.8	Permanent grassland no longer used for production purposes and eligible for the payments/Total UAA
			C.10	Holdings with Fallow land/Total holdings with UAA

I.8	Holding under support of Art. 19 Meas. 6.1 and 6.3 (Reg. 1305/2013) and Art. 50 (Reg. 1307/2013)/Total holdings	C.13	Number of holders with no more than 40 years of age/Total number of holders

Acknowledgements

References

Cohesion Policy Department DPS. 2021. Agenzia per la coesione territorial 2015. Le aree interne: di quale territori parliamo? Nota esplicativa sul metodo di classificazione delle aree. Methodological note.

BARCA F., MCCANN P. 2011. Outcome indicators and targets. DG Regional Policy by an expert group. High Level Group Reflecting on Future Cohesion Policy.

BECATTINI G., ZORINI L. O. 2003. Identità locali e globalizzazione. QA - Rivista dell'Associazione Rossi-Doria. - Associazione per studi e ricerche Manlio Rossi-Doria. - 2003, 1, 0134.

CAPELLO, R., NIJKAMP P. 2009. *Handbook of regional growth and development theories.* Cheltenham UK: Edward Elgar Publishing.

FINOCCHIO R. 2008. Processi di diversificazione multifunzionale nelle imprese agricole marchigiane. *Associazione "Alessandro Bartola" Studi e ricerche di economia e di politica agraria PhD Studies* Series: Volume 3.

GRECO M., FUSCO D., GIORDANO P., MORETTI V., BROCCOLI M. 2013. Misurare la multifunzionalità in agricoltura: proposta di un indice sintetico. *Agriregionieuropa anno 9 n°33*, Set 2013.

HENKE R. (2004). Verso il riconoscimento di una agricoltura multifunzionale. *Teorie, politiche, strumenti*, Roma, INEA.

HENKE R., SALVION C. 2013. I redditi in agricoltura, processi di diversificazione e politiche di sostegno. INEA, Roma.

LUCATELLI S., STORTI D. 2019. La strategia nazionale aree interne e lo sviluppo rurale: scelte operate e criticità incontrate in vista del post 2020. *Agriregionieuropa anno 15 n°56*, Mar 2019.

MUSOTTI F. 2018. Sistemi agroalimentari locali e sviluppo delle aree interne: riflessioni alla luce dell'economia della cultura. *Contribute for XXXIX Conferenza Italiana di Scienze Regionali*, Bolzano.

ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD) 2008. *Handbook on Constructing Composite Indicators METHODOLOGY AND USER GUIDE.* JRC European commission.

SUMMARY

The National Strategy for Inner Areas (SNAI) represents an innovative national policy of territorial development and cohesion and a decisive priority for development for the socio-economic recovery of the country and the Inner Areas. In these areas, the agricultural sector plays a central role, as an economic opportunity and for the value of care and protection of the environment. SNAI is strictly linked to NSP Policies. In this study, we have made a merge between Inner Areas (IA) and D-Areas of NSP: 1,327 municipalities could receive funds both for the Inner Areas and for NSP (D Areas - rural areas with comprehensive development problems.) strategies.

The new economic and financial context requires the diversification of production system. For the Agricultural sector diversification means multifunctionality, in terms of production of secondary goods and services of various kinds, together with the production of goods for human and animal consumption, to diversifying income and avoiding risk factors.

The aim of this study is to represent the definitional complexity of multifunctionality and synthesize it in such a way as to express, at the territorial level, the resilience of farms.

For this goal, we define a theorical model starting from the identification of available data sources (Agricultural census 2020 and IACS) the identification of three Pillars, starting from a previous work (Greco *et al.*, 2013), in which five conceptual areas or domains (pillars) were considered: 1) landscape protection, 2) diversification of activities, 3) environment, 4) food quality and 5) land protection. To measure the multifunctionality of IA, we focus on domains two and four. The first, because it expresses a different disarticulation in the productive factors and in the production of a more varied output, the second because it allows to bring out specificity the development of rural tourism. Besides, we added a new pillar, Rural tourism support, as spur for the agricultural productivity by promoting the production, use and sale of local production in tourist destinations and its full integration in the tourism value chain. The study identifies a set of 31 indicators useful for the computation of these phenomena, keeping in mind the opportunity given by the continuous Agriculture census (from 2023) data source, to allow the analysis of trends and analyzes the weight of farms on tourism potential. Thanks to the presence of a unique code, the integration with the administrative data added new important variable at the census results. The outcome provides a tool for the monitoring of Inner Areas with a view to assessment of the resilience of territories.

_____

Antonella BIANCHINO, Istat, bianchin@istat.it
Daniela FUSCO, Istat, dafusco@istat.it
Paola GIORDANO, Istat, pgiordano@istat.it

A PANDEMIC HEALTH RISK MANAGEMENT MODEL FOR THE PROTECTION OF WORKERS: THE ISTAT EXPERIENCE[1]

Michele Camisasca, Eva Pietrantonio, Rosario Magro, Alessandro Arborea, Anna Fabiani, Claudio Giordano, Marcella Pietrantonio, Adeodato Sparano

1. Introduction

The 2020 *SARS-CoV-2* pandemic emergency pushed public Administrations to adopt gradual and timely managerial, organizational and technical choices for the health and safety protection of workers from this new risk. The National Institute of Statistics – Istat faced this extraordinary moment by ensuring the continuity of the official statistics activities in a sustainable way, thanks to the smart-working. During many moments of interaction and/or discussion, different aspects, even marginal, have been examined in depth, implementing innovative solutions in a plurality of areas. In this sense, an innovative work was realized on the organization, the adoption of specific guidelines, the continuous update of risk assessments and protection measures for workers. The health prevention activities carried out by the employer and by the competent doctor were considerable and unique. The monitoring and the traceability of all workers were realized with original questionnaires to identify the "*fragile workers*" and the situations requiring specific prevention measures. The questionnaires were proposed to all Istat employees by email and dynamically updated (Camisasca *et al.*, 2021).

The aims of this work are to show an innovative model for pandemic health risk management to ensure workers health and safety in offices and remote activities[2].

After briefly mentioning the Regulations in force during the health emergency, the following paragraphs will deal with the study case examined and the measures implemented by the employer with the technical support of the prevention and protection service and the competent doctor, through the electronic questionnaires proposed to all workers. For this purpose, the questionnaires and the other prevention and protection measures have proved to be a useful tool for the preventive containment of *COVID-19* spread in the Istat offices. It will be also explained in detail the data analysis and how the questionnaires were constructed. Furthermore,

---

[1] This article is the result of the common contribution of all and, therefore, the individual contribution is considered equal and equivalent to that of the other co-authors.

[2] ITALIAN LEGISLATIVE DECREE n. 81, 2008 April 9.

it will be examined how the different questionnaire sections allowed acquiring the data for the personnel with the fragility tracing. Finally, the conclusive paragraphs report the results achieved and some final considerations on the work done.

2. Materials and methods

In Italy, the pandemic effects due to the new *SARS-CoV-2* coronavirus have caused a health emergency, which has been immediately faced with a series of urgent measures since the declaration of the state of emergency on January 31, 2020. Several Decrees of the President of the Council of Ministers - DPCM[3], regional ordinances and decrees of the Ministry of Health have been necessary to determine a containment of epidemiological effects, for instance, special health surveillance measures and travel ban especially for subjects with *COVID-19* symptoms. For this aim the employer, in agreement with the Istat competent doctor, proposed three questionnaires for all Istat workers. In the Table 1 are grouped the typologies of specific questions proposed in the three questionnaires.

Table 1 – *Typologies of specific questions proposed in the three questionnaires.*

Type of specific questions	Number of questions 1st Questionnaire	Number of questions 2st Questionnaire	Number of questions 3st Questionnaire
- personal data and information on the employee and his/her work situation	16	14	10
- personal medical history	5	5	1
- cohabitant medical history	10	2	2
- travel and transfer	-	8	4
- cases of exposure to contact	-	6	4
- evaluation of personal symptoms	2	5	1
- evaluation of cohabiting symptoms	2	5	-
- any clarification notes	5	7	2
- making / booking anti*COVID-19* vaccine	-	-	2

Source: Questionnaire proposed by the Istat competent doctor.

Each one of the three questionnaires consists of about 40 questions that aimed to verify potential cases of susceptibility or hypersensitivity due to pathologies or pharmacological treatments. In the Table 2 are reported the grouping created by competent doctor evaluation and colour classification assigned to Istat workers with the related specific prevention and protection measures.

---

[3] Italian Decree Of The President Of The Council Of Ministers - Dpcm, 11 March 2020; Italian Law Decree N. 125, 2020; Italian President Of The Council Of Ministers, Minister Of The Economy, Minister Of Labor And Social Policies, Minister Of Economic Development, Minister Of Health, And Social Partners, 2020.

Table 2 – *Grouping created by competent doctor evaluation and colour classification assigned to Istat workers for prevention and protection measures.*

Group	Prevention and protection measures
Green	- Favourable outcome to the offices access maintaining general precautions adopted by Istat; - favourable outcome to the Istat offices access on condition of traveling with your own vehicle; on days when it is not possible to use the vehicle keep the work from remote; - favourable outcome to the offices access on condition to access to the Institute at times when there is evidence of decreased travel by the general population; - limit activities in the presence of other colleagues or outsiders and always maintain social distancing over 2 meters, preferring more activities in conference call.
Yellow	- Strictly comply the measures of greater protection already arranged within the Institute and limit the interaction with colleagues or external parties to the indispensable even in common areas; - strictly comply with the measures of greater protection already established within the Institute and limit the interaction with colleagues to the indispensable even in the common areas; grant access to the Institute at times when there is evidence of decreased travel by the general population.
Red	- Go on to remote work and non-presence in the Institute until the declared cessation of the national emergency; - go on to remote work and non-presence in the Institute by scheduling up to 2 weekly accesses until declared end of national emergency; - go on to remote work and non-presence in the Institute; for mandatory access (one per week) plan the use of their own vehicle or grant access to the Institute at times when there is evidence of decreased travel by the general population; - go on to remote work and no presence in the Institute by scheduling up to a maximum of 2 accesses per week on condition of granting access to the Institute at times when there is evidence of decreased travel by the general population until declared end of national emergency; - go on to remote work and no presence in the Institute except for limited access up to 2 days a week until declared end of national emergency; - go on to remote work and no presence in the Institute by planning up to a maximum of 3 accesses per week on condition of granting access to the Institute at times when the decrease in movements of the general population is proven until declared end of national emergency.
Black	- Questionnaire NOT completed.

Source: Prevention and protection measures obtained from the questionnaire conducted by the Istat competent doctor.

The first and second questionnaires of the anti*COVID-19* tracing activity were conducted in 2020 while the third questionnaire was conducted after the opening of the vaccination campaign in the 2021 and on a very small sample of "*fragile / susceptible workers*" only. The second questionnaire was supplemented with other questions concerning both "*travel and transfer*" and "*cases of exposure to contact*" due to changes in epidemiological scenarios. The third questionnaire was proposed only to the "*fragile / susceptible*" sample, identified by the Istat competent doctor,

and it included free questions on the anti*COVID-19* vaccination in view of the gradual return of employees to the office.

The analysed data are provided in aggregate and anonymous form so it is not possible to trace and to identify the employee who completed the electronic questionnaires. They are structured in compliance with privacy regulations and professional confidentiality. The questions allowed the competent doctor to ascertain possible exposures to risk factors, such as close contacts with positive people and to have information about the use of public transport for home-work routes. Health protection measures were adapted to the level of risk and extended to the entire family. Thanks to the questionnaires it was possible to classify all Istat employees into four groups, each one identified by a colour (Green, Yellow, Red, Black) with specific prevention and protection measures (for the Green Group no additional measures, for the Yellow Group measures that reduce interactions, for the Red Group prevalence of remote work, finally the Black Group refers to non-respondents).

2.1. *Prevention and protection measures*

The competent doctor developed the questionnaires as a useful tool for the preventive containment of *COVID-19* spread, as a specific health prevention and protection measure to identify and trace "*fragile / susceptible workers*" with the aim of classifying them according to specific prevention measures, also in order to return to the office.

More general and specific protection measures of organizational and technical nature were introduced by the Institute to reduce the probability of infection and to prevent the origin of epidemic outbreaks (Iavicoli *et al.*, 2020). The main measures are summarized briefly below in Table 3. The specific document "*Mandatory prevention measures to limit the risks from the new coronavirus for the Istat's Roman offices*" has been elaborated, disseminated and used for information. It contains all the mandatory measures for Istat workers and for outsiders (visitors, contractors, suppliers, etc.). The information section played an important role, both in the first and second questionnaires. This section provided the general definitions of "*close contact*" and the modalities for office accessing, the general and specific protection measures within the Institute, infographics on the management procedures of a symptomatic person, instructions for the correct washing of hands, instructions for the correct use of disposable gloves, instructions for the correct use and removal of the surgical face masks with filter.

Table 3 – *Main general and specific organizational and technical prevention and protection measures adopted.*

- Specific questionnaires proposed by the competent doctor
- Interpersonal distance of at least two meters
- Working methods in smart working and teleworking to reduce contact opportunities
- Minimization of the use of public transport and preference for less crowded hours
- Use of respiratory protections (FFP2 masks, surgical face masks), gloves where necessary
- Temperature control at entrances
- Regulation of access and presence in the Institute of external personnel
- Preparation of mandatory paths
- Contingent use of lifts and bathrooms one person at a time
- Distancing of workers' workstations in rooms, to maintain social distancing
- Regulation of internal travel, meetings, internal events, training and missions
- Contingent access to common areas
- Hygiene, frequent hands washing
- Cleaning, sanitizing and disinfecting work environments, surfaces and toilets with effective products
- Rooms ventilation and periodic sanitization of the ventilation systems
- Use of the Green Pass as a safety measure

Source: Istat, Risk assessment document for internal use, 2020-2021.

3. Results

The implemented prevention and protection measures ensured the maximum protection of Istat workers and the continuation of all the official statistics activities during the pandemic. The tracing activity was possible thanks to specific questionnaires proposed to all employees and a direct contact with workers in order to define specific and accurate prevention measures, where necessary. The first and second questionnaires of the anti*COVID-19* tracing activity were conducted in 2020 while the third in 2021 and only on a very small sample of "*fragile / susceptible workers*" of the Red Group. The questionnaires results and data analysis on the workers population are provided anonymously with a general overall summary in aggregate form in the next subparagraphs.

### 3.1. 1st and 2nd questionnaire results

The results of the anti*COVID-19* questionnaires for the tracing activity are shown in Table 4. The table shows that survey participation was massive. Almost all workers joined aware of the strong protection value of the proposed survey tool.

Table 4 – *Questionnaire results of Istat workers (Absolute values and %). Year 2020.*

Group	1st Questionnaire		2nd Questionnaire	
	Total	Per 100 Istat Workers	Total	Per 100 Istat Workers
Green	984	57,6	1.140	68,0
Yellow	191	11,2	113	6,8
Red	472	27,7	415	24,8
Black	59	3,5	6	0,4
Total Istat Workers	1.706	100,0	1.674	100,0

Source: Questionnaires data processing conducted by the Istat competent doctor

Istat workers distribution shows a female prevalence (61% Female, 39% Male). In the two surveys, the respondents number is similar, although slightly lower in the second (Istat workforce decreased during the months of the year (from 1.706 to 1.674, due to retirements, temporary detachments, etc.)). In addition, the Red Group distribution slightly decreased (from about 28% to about 25%) as shown in Figure 1. In the Red Group, the most stringent prevention measures have reached the highest protection level. After the analysis of the second questionnaire (conducted only on the Red Group) the competent doctor carried out additional investigations, also through direct contacts with some workers, in order to accurately evaluate every single peculiar situation.

Figure 1 – *Istat workers were classified in different categories on the basis of the survey results conducted by the competent doctor: 1st Questionnaire (left) and 2nd Questionnaire (right) (Values %). Year 2020.*
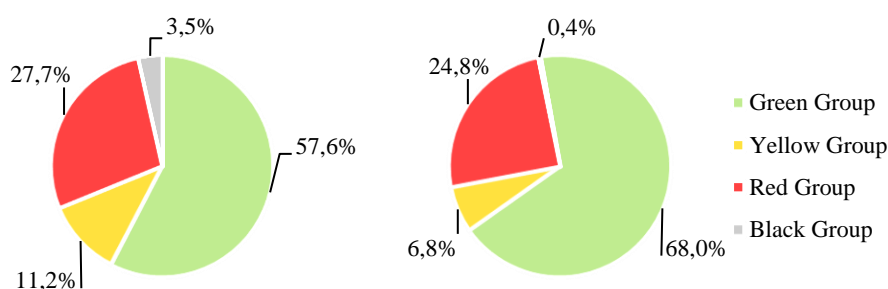
Source: Questionnaires data processing conducted by the Istat competent doctor

Figure 2 – *Istat workers were classified in different categories on the basis of the survey results conducted by the competent doctor, by age groups: 1st Questionnaire (left) and 2nd Questionnaire (right) - % values on the total number of workers. Year 2020*
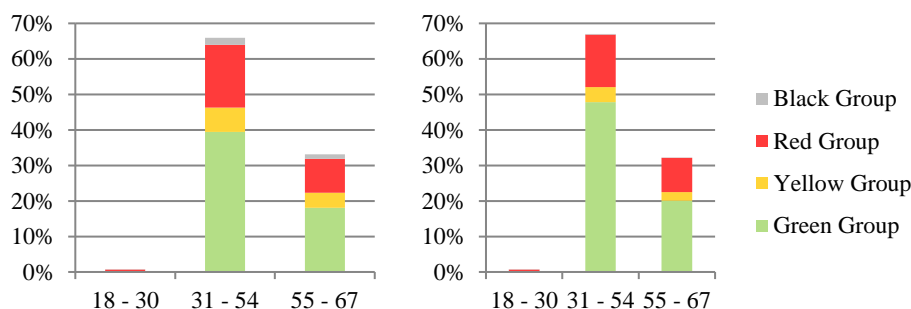
Source: Questionnaires data processing conducted by the Istat competent doctor

In Figures 2 and 3, the population subdivision is also shown by multi-year age groups. The second questionnaire shows that the percentage of workers in the Green Group has increased compared to the first, at the expense of the Yellow Group, as a result of the resolution of some "*border line*" cases to be investigated, which in a first analysis had been assigned to other Groups, as shown in Figure 2. Figure 3 shows how the relative distribution by age Groups is similar in the 31-54 and 55-67 years' classes.

Figure 3 – *Istat workers were classified in different categories on the basis of the survey results conducted by the competent doctor, by age groups: 1st Questionnaire (left) and 2nd Questionnaire (right) (for 100 workers of the same age group). Year 2020*

Source: Questionnaires data processing conducted by the Istat competent doctor

The workers of the Green Group prevail and as the ones of Yellow Group, require more limited protection measures. The situation is clearly reversed in the 18-30 age

Group where the Red Group becomes considerable. Data showed clearly how the youngest workers were the most fragile, therefore it was necessary to implement more stringent protective measures.

3.2. 3rd questionnaire results

The third questionnaire was proposed in June 2021 and conducted only on about 226 "*fragile / susceptible workers*" (Red Group).

Figure 4 – *3rd Questionnaire Istat workers grouped by gender (left) and grouped by age (right) (Values %). Year 2021*

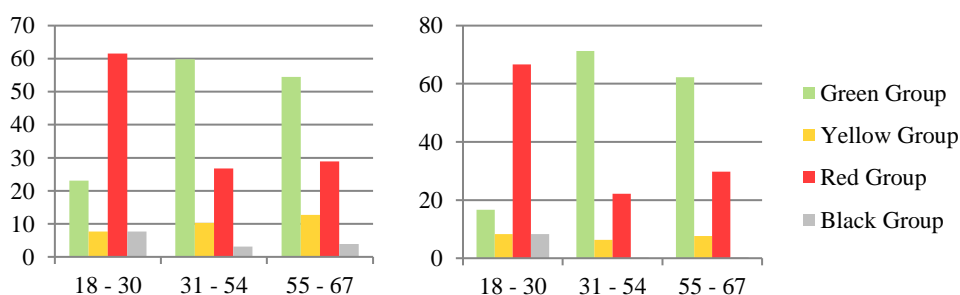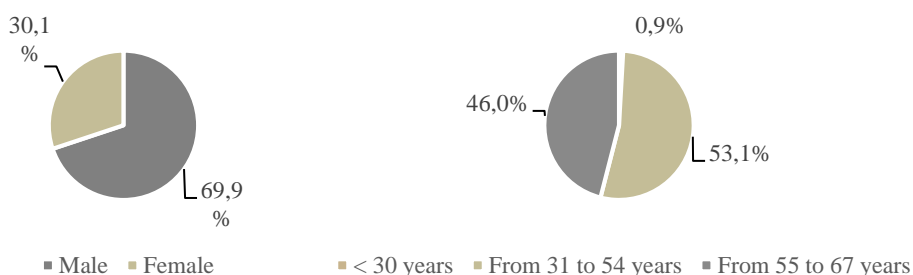*Source: Questionnaire data processing conducted by the Istat competent doctor*

In addition, the third questionnaire reports the results about free questions on the anti*COVID-19 vaccine*. In Figure 4 the graphs show the male prevalence (about 70%) in the Red Group and the greatest concentration of "*fragile / susceptible workers*" aged between 31 and 54 years (over 53%), followed by the class between 55-67 years represented by 46%, while the class 18-30 years is the smallest compared to the total of "*fragile / susceptible workers*" (about 1%). Figure 5 shows that the most "*fragile / susceptible workers*" use either public transport (over 60%) or mixed transport (car, scooter, etc.) (over 22%) and take 30 to 45 minutes (32,7%) to go to work and followed by those who take 45 to 60 minutes (28,8%).

Figure 5 – *3rd Questionnaire Istat workers grouped by means of transport used (left) and by time taken (right) to arrive to the office (Values %). Year 2021*
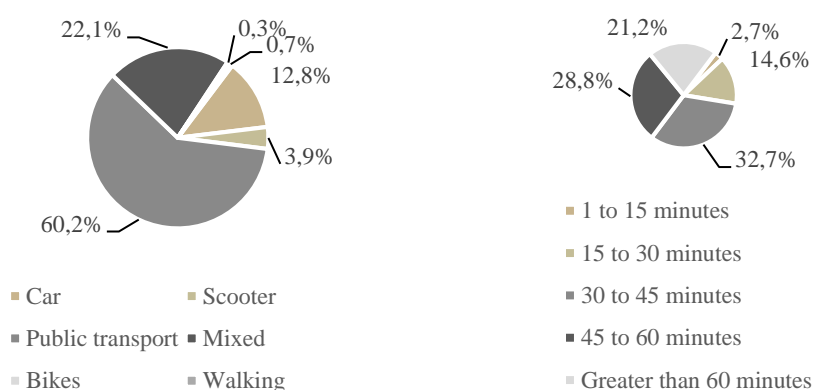
Source: Questionnaire data processing conducted by the Istat competent doctor.

Figure 6 – *3rd Questionnaire Istat workers who have or have not contracted COVID-19 infection in the last 12 months (left) and who making / booking or not the anti-COVID-19 vaccine (right) (Values%). Year 2021*
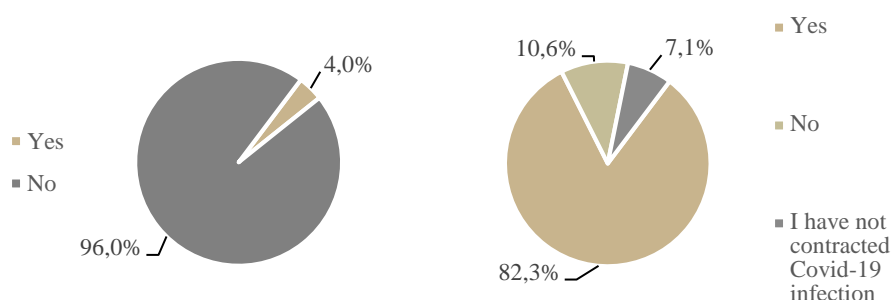
Source: Questionnaire data processing conducted by the Istat competent doctor.

In Figure 6 the graphs show (left) that about 4% of "*fragile / sensitive workers*" (Red Group) contracted *COVID-19* infection, while (right) the sample majority (about 82%) made / booked the anti*COVID-19* vaccine in 2021. Only about 11% of the sample answered negatively and about 7% of the sample did not intend to answer the proposed question. The Figure 7 graphs show that only 0,9% of "*fragile / susceptible workers*" (Red Group) who contracted *COVID-19* infection had to resort to hospitalization for the necessary care. About 2,7% among those who contracted the infection, presented after-effects of the disease post recovery.

Figure 8 – *3rd Questionnaire Istat workers who have been hospitalized or not for COVID-19 in the last 12 months (left) and who have contracted COVID-19 infection with after-effects of the disease (right) (Values %). Year 2021*
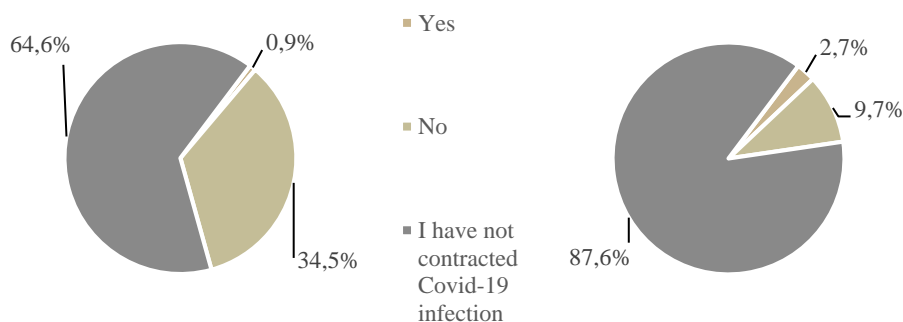
Source: Questionnaire data processing conducted by the Istat competent doctor

4. Conclusions

The pandemic risk management from *SARS-CoV-2* required the use of innovative, timely tools, never adopted before in these contexts for which there were not previous consolidated reference experiences. These tools permitted the risk assessment and the definition of efficient prevention and protection measures. The pandemic required a significant effort, the employer had to realize structural (sanitization, temperature check, separation of paths, etc.), health (health surveillance through the tracing of the "*fragile / susceptible workers*") and management (employees' placement, for example one per room, prohibition of holding meetings, etc.) actions. Moreover, the measures have been adopted on the basis of the epidemiological evolution following its severity. It was extremely effective to integrate existing risk analysis methods and prevention measures of containment and exposure reduction with original questionnaires of traceability of all workers by the competent doctor. The prevention and protection measures implemented during the pandemic, in fact, guaranteed the maximum protection of Istat workers by preventing the development of infections in the work environment and the continuation of all activities on official statistics.

References

CAMISASCA M., PIETRANTONIO E., MAGRO R., ARBOREA A., FABIANI A., GIORDANO C., GUERRIERO G., SPARANO A. 2021. Biological risk

assessment from COVID-19 in the workplace of the National Institute of Statistics during the pandemic: prevention and protection measures also for the health protection of fragile workers. *Istat Working Papers N.6*, Italian National Institute of Statistics.

ITALIAN LEGISLATIVE DECREE of 9 April 2008 n. 81. Text coordinated concerning the protection of health and safety in the workplace.

ITALIAN DECREE OF THE PRESIDENT OF THE COUNCIL OF MINISTERS - DPCM of 11 March 2020. Further implementing provisions of the Law Decree 23 February 2020, n. 6, containing urgent measures regarding the containment and management of the epidemiological emergency from COVID-19, applicable throughout the country.

ITALIAN LAW DECREE of 7 October 2020 n. 125. Urgent measures connected with the extension of the declaration of the epidemiological state of emergency from COVID-19 and for the operational continuity of the COVID-19 alert system, as well as for the implementation of Directive (EU) 2020/739 of 3 June 2020.

ITALIAN PRESIDENT OF THE COUNCIL OF MINISTERS, MINISTER OF THE ECONOMY, MINISTER OF LABOR AND SOCIAL POLICIES, THE MINISTER OF ECONOMIC DEVELOPMENT, MINISTER OF HEALTH, AND SOCIAL PARTNERS of 14 March 2020. Shared protocol for regulating measures to combat and contain the spread of the COVID-19 virus in the workplace.

IAVICOLI S., BOCCUNI F., BURESTI G., GAGLIARDI D., PERSECHINO B., RONDINONE B.M., VALENTI A. 2020. *Technical document on the possible remodulation of measures to contain SARS-CoV-2 infection in the workplace and prevention strategies*. Rome: INAIL, Department of Medicine, Epidemiology, Occupational and Environmental Hygiene.

SUMMARY

The *SARS-CoV-2* pandemic emergency pushed public Administrations to adopt managerial, organizational, and technical choices for the health and safety protection of workers. In this extraordinary context, Istat enhanced its IT support, ensuring full operation in a sustainable way with smart working. All this influenced the sociability of the employees by developing interactions via web with discussion moments on different aspects in a plurality of areas. The health prevention activity was innovative and unique, carried out through the monitoring and tracing of all workers, with the use of questionnaires created ad hoc that allowed the competent doctor to identify fragile workers and situations susceptible to *COVID-19* contagion for which further risk reduction measures have been adopted. The aim of this work is to illustrate an innovative model of health risk management aimed at identifying and monitoring risk conditions and defining protection measures with important actions by the employer. All of this to ensure maximum health and safety protection of workers who have

worked, both at the offices and remotely. Istat implemented the Prime Ministerial Decree and other Regulations issued on the coronavirus spread containment, furthermore, proposed to Istat workers two questionnaires, prepared by the competent doctor. Each questionnaire included about 40 structured questions aimed at verifying, in compliance with privacy regulations, any susceptibility or hypersensitivity cases due to previous or current pathologies, to pharmacological treatments interacting on the immune system, to possible exposures to risk factors (such as close contacts with positive cases, the use of public transport for home-work routes). The questionnaires results, anonymous and aggregated, and data analysis on the working population, are provided with an overall summary. The questionnaire made it possible to group Istat employees into four groups, each identified by a colour, characterized by specific prevention measures for the return to the office. The population surveyed was comparable in the two surveys; the distribution in the Red Group recorded a slight decrease (from about 28% to about 25%). For this Group, the most stringent prevention measures reached the highest level of protection. After the analysis of the second questionnaire, the competent doctor carried out additional investigations to accurately evaluate every single peculiar situation of the workers.

_____

Michele CAMISASCA, D.G. Istat, michele.camisasca@istat.it
Eva PIETRANTONIO, Istat, epietrantonio@istat.it
Rosario MAGRO, Istat, rosario.magro@istat.it
Alessandro ARBOREA, Istat, arborea@istat.it
Anna FABIANI, Istat, anfabian@istat.it
Claudio GIORDANO, Istat, claudio.giordano@istat.it
Marcella PIETRANTONIO, Istat, pietrantonio@istat.it
Adeodato SPARANO, Istat, spp@istat.it

IMPACT OF DIGITAL LEARNING ON THE INTERVIEWER'S PERFORMANCE

Nunzia Balì, Claudio Ceccarelli, Maria Teresa Fiori, Alessandra Lugli,
Francesca Rossetti[1]

1. Introduction

New organizational and methodological challenges, caused by recent pandemic crisis, have been faced in public statistics in order to pursue the cognitive objectives and the commitments undertaken at national and international level, in compliance with the qualitative standards relating to all stages of production processes.

In this new scenario, as regards the training of the survey network, Istat has chosen to use "distance" training tools instead of the traditional face-to-face approach, as well as new types of training organization and production of training materials.

In this paper, we describe the training strategies with reference to the release of the Permanent Population and Housing Census 2019, before the pandemic crisis, compared to the strategies of 2021 edition (Balì, 2019).

To evaluate the impact on the performance of the interviewers, we propose a statistical analysis based on the logistic model. The comparison will be produced using several indicators relating to the socio-demographic characteristics of the interviewer, his experience in the activity, the assessment of the skills acquired with the use of the training modules and measured during the final training test.

In section 2, the educational context for the Census 2019 and 2021 edition is focused. In section 3, are explained the data and the indicators used in the analysis. Section 4 illustrates the results of the statistical analysis and highlights the differences between the two censuses experiences declined with respect to the characteristics of the interviewers.

Finally, in section 5, some conclusions are drawn, indicating how the training strategy will evolve over time in order to capitalize and optimize the innovations introduced as a result of the pandemic.

---

[1] The article was only possible thanks to the joint work of the authors. In particular Claudio Ceccarelli wrote section 1, Alessandra Lugli wrote section 2.1 and 2.2, Maria Teresa Fiori wrote section 2.3, Francesca Rossetti wrote sections 3 and 4, Nunzia Balì wrote section 5.

2. The educational context for the Permanent Population and Housing Census

2.1 The international experiences for the educational frame for Population and Housing Census

Here we report some experiences of foreign countries in which we indicate how they dealt with the training of interviewers in the COVID 19 pandemic in order to complete the population and housing census (United Nations ECE/CES/GE.41/2022/9).

Table 1 – *International comparisons on training of interviewers during the covid19 pandemic*

COUNTRY	YEAR	BUREAU	EXPERIENCE
IRELAND	2022	Central Statistics Office (CSO)	As the pandemic continued, they decided to delay the census until 3 April 2022
All the field recruitment processes were redesigned and moved online. Interviews were held virtually with required documentation uploaded to a specially designed portal. The whole process became virtually paperless Training for the field staff was redesigned to be provided online.			
FRANCE	2022	French statistical institute (INSEE)	The data collection scheduled for 2021 was postponed to 2022 due to the health crisis.
The 2022 ACS started on 20 January 2022 and was carried out successfully. The 2022 survey, which is currently being processed, will soon enter the usual process for the production of population census results. They did not change the survey because they realized it in 2022 at the end of the pandemic crisis.			
CROATIA	2021	Croatian Bureau of Statistics (CBS)	The 2021 census was carried out from 13 September to 14 November 2021
They realized all the training on-line. Do the benefits of online training outweigh its drawbacks? In the 2021 census, online training was prepared and implemented in Croatia for the first time. Training of enumerators lasted for four days. Online training has many benefits, however, with online training it is more difficult than with face-to-face training to assess which enumerators have attained the required knowledge. This drawback became apparent during data collection in the field, when it was clear that some enumerators and their immediate superiors had not adopted a significant part of the methodology. Some enumerators and supervisors had difficulties joining virtual training which led to their frustration and caused the candidates to either avoid the course (to a lesser extent) or to focus on the technology rather than the content of the course (more often). In those cases, additional trainings were implemented. In addition, training material was recorded and made available to all census personnel.			

COUNTRY	YEAR	BUREAU	EXPERIENCE
POLAND	2021	Statistics Poland	The National Population and Housing Census 2021 was conducted on the territory from 1 April to 30 September 2021.

At the time when the greatest number of cases was recorded, the work carried out for the census was performed remotely, as in the case of remote recruitment of candidates for enumerators or remote training. Due to the COVID-19 pandemic, the recruitment of candidates for census enumerators took place remotely. All training was conducted remotely, using Lync/Skype or Webex communication platforms.

COUNTRY	YEAR	BUREAU	EXPERIENCE
UK	2021	Office for National Statistics (ONS)	A census for England and Wales was carried out in March 2021, and at the same time for Northern Ireland. The Scottish Government decided to delay the census in Scotland by a year because of operational problems caused by the Covid-19 pandemic. Scotland's census took place in March 2022.

Response rates to the census were high, with forms completed by an estimated 97% of households in England, Wales and Northern Ireland. We do not have any information about the training of the interviewers and if the data collection was as usual.

COUNTRY	YEAR	BUREAU	EXPERIENCE
USA	2020	United States Census Bureau	In 2020, amidst a global pandemic, the United States (U.S.) conducted its once-a-decade census of population and housing.

The Census Bureau combines administrative data with survey data. Some data are collected from respondents directly (including businesses). Primary sources for additional data are federal, state, and local governments, as well as some commercial entities. We do not have any information about the training of the interviewers and if the data collection was as usual.

COUNTRY	YEAR	BUREAU	EXPERIENCE
MALTA	2021	National Statistics Office Malta (NSO)	The census included technical and methodological innovations, this was a transitional census

Nearly 30 training sessions for district managers, supervisors, enumerators and call centre personnel were held in Malta and Gozo between September and November 2021. Although the delivery of physical training sessions was a rather cumbersome task in view of COVID- 19 restrictions, particularly due to the social distancing protocols which had to be observed at all times, each session covered all salient generic and technical aspects related to the Census and included a practical session with a detailed overview of the systems available to enumerators and other staff.

2.2 *The Italian educational frame in 2019*

The design of the training system of the survey network for the 2019 edition of the "permanent population and housing census" did not present a particular complexity, given the experience of the 2018 edition (Balì and Federici, 2014).

In the first place, no distinctions had been thought between operators who worked only for survey "distribution range survey" (from now named survey A in the article) or only for survey "lista based survey". (from now named survey L in the article). The training conceived for all the operators on both surveys, the idea was that each operator is trained in general for the census operations and is in some way interchangeable on different activities and in different municipalities. Instead, a diversification was introduced between old and new operators in order to lighten and make the innovations more evident for new operators. Centralized training events were also organized for other operators, such as those of the Contact center, the Service desk and the Istat switchboard. The framework of the training was mixed, organized partly through self-learning modules (using the Moodle platform) and partly there were training events organized in person and throughout the Italian territory. The training was compulsory as well as the carrying out of the tests (intermediates and final), the passing of which was subject to a minimum threshold, with subsequent certification of the Distance Training (FAD) carried out. Support materials were also prepared such as survey manuals (for both L and A survey) and other guides were written for the IT part.

Two training courses were built on the ISTAT Moodle platform:
- new municipal operators
- update for the expert municipal operators

Over 14 thousand people were trained for the year 2019. In particular:
- 18,349 people were registered on the Moodle platform
- 14,587 people attended at least one training event and of these 13,422 had completed the final test scheduled at the end of the FAD.

In particular, the situation was the following:
- 13,478 people completed the FAD and attended at least one training event;
- 13,966 started the FAD and were present at a training event;
- 1,822 were not called to any training event.

Distance education- Forms

For the 2019 edition, 18 training modules were carried out for new operators and 10 training modules were carried out for expert operators on the Moodle Platform.

After ending the FAD the operators were gathered for a day training in presence.

Test and Grades

In the FAD in both courses there were several intermediate assessment tests and a final test which gave access to the meeting Classroom in presence.
The intermediates tests were 12 for the new operators while they were seven in the expert operators course, the minimum mark of the intermediate tests was 6/10 while for the final test the minimum mark was 7/10. If the intermediate test was not passed, it was not possible to access to the next module but they could be repeated several times, the same thing was for the final test. 14,173 learners took the final test and the average grade of the final test was 8.8 while the average rating on the Moodle platform was 8.7.

Classroom in presence

Between 19 June and 29 September 2019 there were 599 training events, 16,527 learners were invited to these face-to-face events: of these 14,587 attended at least one training event while 1,822 learners were not called.

Satisfaction Questionnaire

At the end of the training on-line, each participant could fill in the course evaluation questionnaire, divided into 39 questions regarding all the topics of the FAD.

2,268 participants (1158 new and 1100 experts) responded to the questionnaire and the analysis of the data revealed a widespread positive opinion on the training provided. In the majority of cases, the participants expressed a good level of satisfaction (on average 7.9 out of 10). In conclusion, the training platform turned out to be a very or quite useful tool, given that only 7.7% of the participants declared that it needed some improvements in terms of access and internal navigability.

2.3 The italian educational frame work in 2021

The design of the training system of the survey network for the 2021 edition of the "permanent population and housing census" presented a particular complexity, given by the suspension of the 2020 edition of the survey caused by the emergency generated by the pandemic from the Covid19 virus. There was a significant increase in the number of operators to be trained, which numbered more than 20,000 with different roles and profiles (interviewers, managers of the municipal census offices, staff personnel, coordinators, and back office operators). With reference to the two different surveys, most of the operators were involved in both surveys (L survey and A survey), while a minority was involved only in the L survey. Centralized training events (in the virtual classroom) were also organized for other operators, such as

those of the Contact center, the Service desk, the ISTAT switchboard. The articulation of the training was mixed, partly delivered through self-learning modules (through the Moodle platform) and partly in virtual presence (virtual classroom). The use of virtual classrooms in place of face-to-face training also required specific training on the new tools dedicated to the management of the "rooms" and the presence, in addition to teachers, of support figures who would check the number of participants, the management of platform tools and materials presented. The training was mandatory as was the performance of the tests (intermediates and final), the passing of which was subject to a minimum threshold, with subsequent certification of the accomplished Distance Training (FAD). The presence in the virtual classroom was detected, with subsequent insertion of the information in the Survey Management System (SGI). Support materials have also been prepared such as Survey Manuals (for both surveys L and A), guides and tutorials for using the Moodle platform, tablets for data collection, the SGI system, the Rilevo app, the survey questionnaire.

Distance education- Forms

Due to the framework of the SGI system for the year 2021, it was not possible to distinguish the self-learning FAD path between the two surveys: there was a single course in training modules common to both surveys, intended for all users. The self-learning activities involved 19 training modules, mainly consisting of slides with audio, used independently by the learners. The total number of people who completed the FAD was over 21,000.

Test and Grades

In the FAD course, there were several intermediates assessment tests (15) in order to verify the level of learning achieved and at the end of the FAD there was a final test consisting of 30 questions. Both the intermediate and the final test had a minimum threshold of more than 70%, the overcoming of which was a prerequisite for access to training in the virtual classroom.

Virtual- Classroom

In June 2021, a two-day training meeting was organized by Istat (with Istat teachers) for the network of teachers, composed by Istat Territorial Managers (RIT) and teachers from the Statistical Union Italian Municipalities (USCI). A communication and collaboration platform (Microsoft Teams) was used; a follow up event followed in July. A one-day training was organized in the virtual classroom for operators with different roles; those sessions too were organized through the Teams platform starting from September, using the SGI system for the creation of the events and insertion in the various classes of participants. The events carried out

were about 380. Online tools for interaction with the classroom were also tested and subsequently used, which made it possible to carry out quick tests to verify in real time the level of understanding achieved after a single presentation. Finally, over 21,000 participants in the training days in the virtual classroom were registered in the SGI system.

Satisfaction Questionnaire

At the end of the training course, each participant had the opportunity to fill in a course evaluation questionnaire. About 3,400 participants responded to the questionnaire and the analysis of the responses revealed a positive opinion on the training provided. In the majority of cases, the respondents expressed a good level of satisfaction (on average 7.9 out of 10) and 94.7% considered the course useful to start the job. In relation to the duration and timing of the course, 23% of respondents felt that the training in the virtual classroom was too long, while for 21% the time devoted to practice (exercises) was not enough. Various corrections have been suggested both in reference to the FAD and to the support materials and to the organization of the virtual classroom, such as for the latter a relative greater space dedicated to exercises on data collection activities compared to that dedicated to concepts already addressed in self-study.

3. Data and indicators in the analysis

The purpose of the analysis is to verify the impact of different training models, adopted in 2019 and 2021, on the interviewer's performance in the data collection activity of permanent population and housing census. In order to achieve this goal the analysis is carried out using data collected in the training activities selecting only the learners who will play the role of interviewers in the survey and have completed the training cycle: 7,969 in 2019 and 10,127 in 2021.

The training course's outcome for each learner is summarized using a constructed indicator (Ind_votofin) calculated as the ratio between the mark in the final test and the median value of the marks recorded by all learners in the same year of training. The median value of the marks recorded was 8.75 in 2019 and 9.33 in 2021. The analysis of the interviewer's performance focused on the A survey data collection in the permanent census of population and housing. In particular, the attention is on the interviewers who have completed the training cycle and carried out at least one interview in the relative survey year: 7,131 interviewers in 2019 e 8,499 in 2021.

In order to measure the results obtained in the field, two indicators were built:

- Area_ind_perf_a relating to the activity of filling in the questionnaires, calculated by comparing the total number of questionnaires completed by the

interviewer and the median of the total number of questionnaires completed calculated among all the active interviewers in the A survey for the same year (the median was 37 in 2019, 44 in 2021);

- Area_ind_perf_b relating to the address verification activity, calculated as the comparison between the total number of questionnaires completed on the number of addresses checked by the interviewer and the median of the same ratio recorded among all the active interviewers in the A survey for the same year (the median was 1.38 in 2019, 1.16 in 2021).

4. Logistics models and results

In order to measure the propensity of the interviewer to have a good result at the end of the training course and the propensity to have a good performance in the data collection activity three different logistics models are built using the three indicators described above as dependent variable. The explanatories variables in the models are learners' characteristics[2].

Table 2 – *Variables used in the logit models*

| | | DEPENDENT VARIABLES | | | | | |
| | | Ind_votofin | | Area_ind_perf_a | | Area_ind_perf_b | |
		odds ratio	Pr>Chi-Sq	odds ratio	Pr>Chi-Sq	odds ratio	Pr>Chi-Sq
EXPLANATORY VARIABLES	Year's survey			*0.943*	*0.076*	1.069	0.05
	Ind_votofin			1.111	0.002	*1.023*	*0.499*
	geographical area	1.13	<.0001	0.749	<.0001	0.709	<.0001
	Gender	1.196	<.0001	*1.027*	*0.433*	1.094	0.01
	interviewer's experience	*1.072*	*0.054*	0.78	<.0001	2.12	<.0001
	Age in classes	1.133	<.0001	1.128	<.0001	1.217	<.0001
	educational level	0.781	<.0001	1.25	<.0001	1.065	<.0001

Table 2 reports Chi-square statistics with p-value associated for each dependent variables in the models built (the variables without significance in the model are highlighted) and also reports the odds ratio that represent the coefficients in logistic model for explanatories variables[3]. The first model shows that from north to south

---

[2] The variables in the models have been coded: Ind_votofin (0-lower median value; 1-upper median value); Area_ind_perf_a (0-lower median value; 1-upper median value); Area_ind_perf_b (0-lower median value; 1-upper median value); Year's survey (0-2019; 1-2021); geographical area (1-Northwest; 2-North East; 3-Center; 4-South; 5-Islands), Gender (0-Male; 1-Female), interviewer's experience (0- absent; 1- present), age in classes (1- "under 35 years"; 2- "35-44 years"; 3- "45-54 years"; 4- "over 54 years") educational level (1- lower secondary school certificate; 2- upper secondary school certificate ; 3-tertiary certificate).

[3] Similar results were obtained applying weights to the model to make the number of observations comparable between the two annuities in the main strata and using indicator variables for each modality of the explanatory

the propensity to have a training course's good results grows about 20% as this propensity is bigger for women than men and for older than younger. Contrary higher is the educational level lower is the propensity to have good results at the final tests.

The second model reports which factors that influence the propensity to have a good performance in the data collection phase with reference only to the filling of the models. Goods learners have 10% propensity more than bad learners, the propensity of the interviewers operating in the northwest is 25% less than those operating in the islands, the propensity of the interviewers with experience is 20% less than interviewers without experience; increasing age and educational level, the propensity grows.

The third model measures the propensity to have a good performance in the data collection phase with reference to the address verification activity: the geographical area, the age and the educational level have similar effect on propensity than in the second model.

The more interesting difference between this model and the second one is on the odds of the interviewer's experience. Using the Area_ind_perf_b as dependent variable the propensity for interviewers with experience is more than double greater than propensity for interviewers without experience, opposite effect is observed in the model using the Area_ind_perf_a as dependent variable. For both second and third model, the results of training course and the year of survey have a *not significant* or a lower effect on propensity to have a good performance in the data collection.

In conclusion, the main results of the analysis show that there are no significant differences between the two training models in terms of propensity to have a good performance in data collection.

5. Conclusions

Our study allow us to design and develop with greater awareness alternative training models to face to face and shows how is important the training for the interviewers network in the data production process and how it is involved in the quality of work in the field. This article underlines the importance of the training models proposed and how these are significantly influenced by technological changes and unpredictable conditions such as those of the Covid-19 health emergency, which led to highly differentiated training proposals also according to the audience of recipients to be to form.

---

variables. The analysis reported relates to the group of interviewer who for each year completed the training course and were active in the A survey.

A large investment in innovation has been designed for training, in particular for the Permanent Population and Housing Census, for effective and efficient management of the operators by generalizing a mixed training model made up of self-learning situation and situation in the virtual classroom. The training model of 2021, from the experience gained in the field combined with the results of the consultations carried out with teachers and learners, is resulted effectual but it is also necessary to make changes and innovations for the training of population census operators for future training editions (Benigno and Chifari, 2007).

Hence, the training challenge for the new edition of the second cycle of the permanent population census, is to prepare an e-learning teaching where we should be able to create a greater balance between content and practical aspects of exercises with an interaction between technology, teaching materials, operational phases of delivery and configuration of platforms and tools.

References

BENIGNO V., CHIFARI A., 2007, "Strategie per promuovere la presenza sociale in gruppi di apprendimento online", TD Tecnologie Didattiche.

BALÌ N., "Il modello formativo generalizzato" in L'approccio trasversale alla formazione delle reti di rilevazione, a cura di Grassi D. Romano C., Istat, E-Book, 2019.

BALÌ N., FEDERICI A., 2014. Le strategie formative degli attori coinvolti nel lavoro sul campo. In Freguja C., Romano M.C. (a cura di) La modernizzazione delle tecniche di rilevazione nelle indagini socio-economiche sulle famiglie. Istat. Roma.

United Nations ECE/CES/GE.41/2022/9 Economic and Social Council - Meeting of the Group of Experts on Population and Housing Censuses 21 - 23 September 2022

SUMMARY

The recent pandemic crisis has placed public statistics, and therefore Istat, in front of new organizational and methodological challenges in order to pursue the cognitive objectives and the commitments undertaken at national and international level, in compliance with the qualitative standards relating to all stages of production processes. In this new scenario for the training of the survey network, Istat has opted for the use of "distance" training tools instead of the traditional approach to face-to-face training, the organization of training and the production of the training materials.

In this paper we intend to illustrate the training objectives, the organization and schedule of the training activity with particular reference to the innovations introduced, the sharing

and training tools to make a comparison between the two training methods, "face to face" and "distance" and compare the effectiveness of the two approaches.

With reference to the Permanent Population and Housing Census, the results observed in the last survey in 2021, for which training took place in the virtual classroom, will be compared with those recorded in the previous survey for the year 2019, for which the training was provided in person.

For this purpose, using a logistic model, the impacts on the performance of the interviewers will be compared with several indicators relating to the socio-demographic characteristics of the interviewer, his experience in the activity, the assessment of the skills acquired with the use of the training modules and measured during the final training test.

_____

Nunzia BALÌ, Italian National Institute of Statistics, bali@istat.it;
Claudio CECCARELLI, Italian National Institute of Statistics, clceccar@istat.it;
Maria Teresa FIORI, Italian National Institute of Statistics, mtfiori@istat.it;
Alessandra LUGLI, Italian National Institute of Statistics, lugli@istat.it;
Francesca ROSSETTI, Italian National Institute of Statistics, frrosset@istat.it

SAFETY AT WORK IN ITALY IN A GENDER APPROACH: PSYCHOSOCIAL RISKS[1]

Barbara Boschetto, Eugenia De Rosa, Antonella Iorio

1. Introduction

The Italian labour market is still characterized by strong gender inequalities sharpen by the Covid-19 pandemic. Despite the continuous improvement recorded in recent decades, women show a higher unemployment rate than men (10.4% compared to 8.6% in 2020) and a lower employment rate (48.4% versus 66.6%), also due to the persistence of an unequal distribution of family carers' burden. Gaps also concern the type and quality of employment. In fact, women are more employed in part-time and fixed-term jobs compared to men. The higher level of female education does not translate into an advantage in the labour market although it is a protective factor in phases of crisis such as the pandemic one (Istat, 2021a). The labour market in Italy remains strongly segregated. Vertical and horizontal segregation related to the persistence of gender stereotypes that influence women in their study paths and career choices (Barigozzi and Montinari, 2022). In 2020, female employment is concentrated in a limited number of occupations: 50.9% in only 19 while that of men in 51 occupations. Furthermore, women are less likely to reach top positions in organizations. The feminization of work is interlaced with the "ethnicization" of some sectors such as agri-food, care and health. Occupations that concern the "reproduction of life" are covered by Italian and foreign women, interchangeable segments of the labour market characterized by a low level of bargaining and hardly hit by the pandemic (Istat, 2021b). At the same time, the pandemic has called into question the legitimacy of a hierarchy of skills that places all the skills and jobs necessary for the reproduction of life and society on the lowest rung. These occupations have become "key or essential" and, in the world context, protests focused on the lack of safety in the workplace and the absence of personal protective equipment by these workers have been taken place (Bergfeld and Farris, 2022).

---

[1] This article is the joint work of the authors, however paragraphs 1 and 4 are written by Eugenia De Rosa, paragraph 2 by Antonella Iorio, paragraph 3 by Barbara Boschetto.

The pandemic has therefore led to rethink physical and psychological health and safety as a fundamental dimension of work and highlighted the importance of considering gender differences. Firstly, the effects of the gendered structure of the labour market on the exposure of men and women to risk factors at work should be considered. Official data on the Italian context showed the existence, before the pandemic, of significant gender gaps in terms of health and safety at work as well as the peculiarities of some work contexts and types of occupations (Boschetto *et al.*, 2016, 2017). The importance of adopting a gender approach in health and safety at work is also recognized by the Italian legislation. In fact, Legislative Decree 81/2008 introduces the obligation of a risk assessment connected to gender differences in the workplace and a sensitive concept of health and safety at work that is "no longer neutral" but take into account gender differences in risk assessment and prevention measures (Giammarioli, 2017, INAIL 2021). However, this indication to date does not seem widely accepted. Some difficulties are the interconnections between biological and social variables (Conti, 2016) and "the lack of standardized methods to take into account a gender approach ... to evaluate occupational risk concerning organizational and social aspects" (Giammarioli, 2017). Gender should not be considered as a homogeneous category. Multiple and intersecting factors can influence a different exposure to risk factors at work such as socio-demographic (e.g. age, education, citizenship) and employment characteristics (e.g. hourly regime, size of the organizational context, public or private sector). It is also necessary to consider long-term structural changes of the labor market such as feminization and aging of the workforce (Jones, *et al.*, 2011; Collingwood, 2011) as well as greater flexibility and precariousness (Artazcoz *et al.*, 2005). These changes have prompted increasing attention to psycho-social risks (Bongers *et al.*, 1993; Bonde, 2008; Leka and Jain, 2010; Dominique *et al.*, 2013) including harassment and bullying, stress, depression and anxiety. These are aspects can have a strong impact on productivity (Karasek *et al.*, 1990; Luthans *et al.*, 2007; Jones *et al.*, 2011) and on the health and well-being of man and women workers. On this scenario, the health crisis and the consequent economic crisis resulting from the pandemic had a strong impact. Hence the interest in investigating the situation of health and safety at work in Italy, in the context of the pandemic, using data from an Istat study carried out in 2020 on the issue.

2. Data and methods

This study uses data from the 2020 ad hoc module on accident at work and other work-related health problems included into Italian 2020 Labour Force survey.

The survey, conducted by the Italy's National Institute of Statistics (ISTAT), provides the official estimates of the main aggregates of the labour market (numbers in employment and unemployment, people not seeking work) disaggregated by socio-demographic and employment characteristics. The survey is continuous and is carried out every week of the year, with results published monthly, quarterly and yearly. Participants are sampled adopting a two-stage sampling method: municipalities (stratified by demographic size) are used for the first stage and households for the second stage. All household members over fifteen are interviewed. In the 2020 the ad-hoc module on "Health and Safety at work" was submitted only to households in second wave. The module is organised in three sub-modules: accidents at work, work-related health problems, and exposure to physical and psycho-social risk factors at work. The target population is persons aged 16-74 years employed or not employed with a past experience of work. The first, on accidents at work, should establish how many accidents occur and which type, what kind of job was concerned as well as how long a worker was absent due to the accident. The second sub-module, on work-related health problems, analyses the number and types of such health problems, whether they limit the daily activities, characteristics of job and absence from work. The third sub-module, on exposure to risk factors at the workplace, should identify whether a worker is exposed to some relevant risk factors for physical and/or mental well-being. The target group of our study are men and women in employment who responded to question concern the exposure to risk factors for mental well-being at work. The analysis is carried out on 44,665 individuals, 25.096 employed man and 19.569 employed women (22 million and 900 thousand employed people, approximately 9 million employed women). The estimation of the probability of being exposed to psychological health risks, for specific risk factors and at least one was analysed by logistic regression models, stratified by sex and occupation. These models made it possible to calculate odds ratios (OR) with 95% confidence intervals adjusted for potential confounders. Variables used as regressors in the models are age, citizenship, level of education, profession, part time/full time and the type of contract (permanent or fixed term). In order to identify the discriminants of a higher psychological health risk between men and women, an ad hoc aggregation was created at the second level of the Italian classification of occupations (Cp2011). This 13-mode variable groups occupations, is focused on the occupational field or competence ("job families") and not on the occupational level[2]. The gender distribution of these occupational groups shows the great

---

[2] The groups identified are: managers and entrepreneurs; STEM occupations; health occupations; teachers; legal, social and cultural associate or professionals; clerks; sales and restaurant workers; building and metal workers; other types of workers (agricultural, food, textile, etc.); transport and storage workers; cleaners and not skilled occupations; caregivers; armed forces and security workers.

imbalance that exists in the labour market. Some occupations are male-dominated: primarily heavy jobs such as building or metalworkers, or transport and storage workers, but also the more qualified and prestigious occupations that, for historical-cultural reasons, still suffer of a gender gap in favour of men: these are the managerial and scientific occupations. Women, on the other hand, are more present in caring, teaching or other jobs with closer contact with patients or customers: the occupations of teachers, health workers, cleaners and personal care workers are female-dominated (Figure 1).

Figure 1 – *Employed people by occupations and gender. Percentage.*
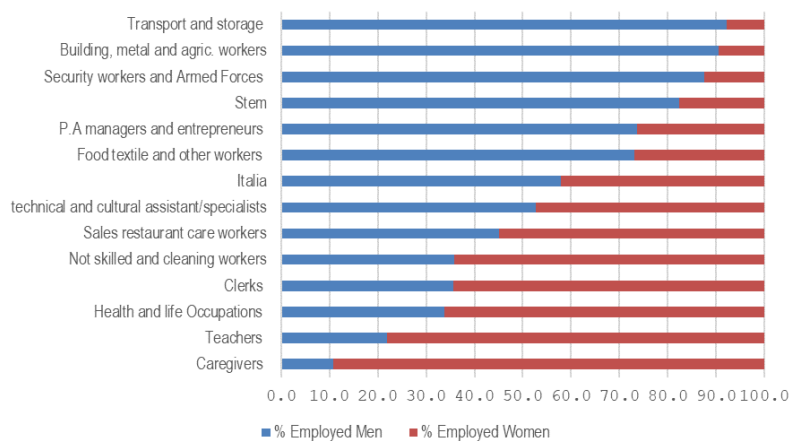
Source: Labour Force Survey: Ad Hoc Module 2020.

3. Results

The main indicators of the 2020 module show some gender differences in occupational health and safety (Istat, 2021c). Among employed persons aged between 16 and 74, men have a higher incidence of accidents at work (1.7% compared with 1.2% of women) and a higher perception of being subject to physical health risks at work (65.2% compared with 58.1% of women)[3]. In

---

[3] The risk factors for physical health observed in 2020 are divided into 11 categories: hand and arm repetitive movements (declared by 32.2% of the employed), painful or tiring positions (31.2%), strong visual concentration (22.0%), handing or moving heavy loads (17.5%), risk of falling, slipping or tripping (17, 0%), exposure to dust, gases, fumes, chemicals (14.1%), risks related to the use of hand or mechanical tools (13.1%), excessive noise (11.9%), vehicle use (9.2%), vibration (7.9%) and the residual category 'other risk factor' (9.2%).

contrast, employed women suffer more from health problems caused or made worse by their work (5.9% vs. 5.2% of men), including stress problems, depression and anxiety, and report greater exposure to psychological health risks at work. 40.9% of women feel exposed to at least one risk factor among those surveyed compared with 37.7% of men.

Gender differences are more pronounced in the youngest age group, between 15 and 34 years (38.5% women vs. 31.9% men and in the oldest age group, 55-74 (39.6% vs. 35.8%). As the educational qualification increases, the exposure to at least one psychological health risk grows for both genders, but in greater proportion for women: the exposure is similar among those with a low education, increases slightly for women in secondary education, and further among those with a tertiary qualification. Among foreigners, the difference is reversed: men are more exposed (30.6%) than women (27.5%).

The gender distribution of the different psychological risk factors shows that women are more exposed to almost all risks (Figure 2).

Figure 2 – *Employed people by psychological risk factors and gender. Percentage.*
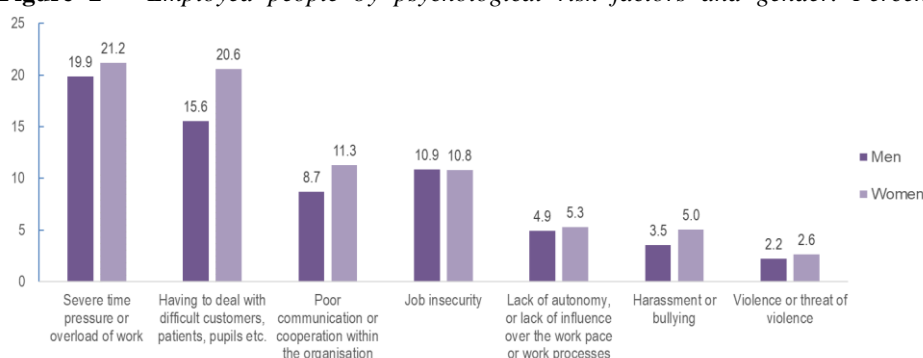
Source: Labour Force Survey: Ad Hoc Module 2020.

Men and women felt some factors similarly: is the case of the fear of losing their job (10.9% men and 10.8% women), the pressing time or excessive workload (21.2% women and 19.9% men) and the lack of autonomy (5.3% women and 4.9% men). Other factors are felt significantly more by women: the risk of having to dealing with difficult patients or clients (20.6% women 15.6% men), lack of communication or cooperation (11.3% vs. 8.7%) and bullying or harassment (5.0% women and 3.5% men). Women also perceive violence or the threat of violence more.

3.1 Health at work: occupations at risk by gender

The logistic regression models show the different probability of feeling exposed to psychological health risks between men and women and between different occupations. First by using the reconstructed indicator expressing 'feeling exposed to at least one risk factor', among the eight investigated, as the dependent variable, and then in detail using specific risks as dependent variables.

In order to examine the interaction between occupation type, gender and the perception of at least one risk factor for psychological health, an aggregate occupation variable was created. The variable groups, distinctly by gender, occupations into four level mode: intellectual, conceptual, skilled manual and unskilled manual occupations, excluding the Armed Forces. This variable was used as independent in the logistic regression model, with other potential confounders, including some job and socio-demographic characteristics, in order to highlight which elements present a significantly higher probability of perceived risk for psychological health.

The type of occupation, crossed by gender, indicates that women perceive the risk to a greater extent than men in all occupational groups except for unskilled occupations (figure 3). Women employed in intellectual or managerial occupations have a 20% higher exposure to psychological risk than men employed in conceptual occupations, the reference category, (IC 95%: 1.11-1.31), the same proportion is also observed among women employed in skilled manual occupations, such as trade and skilled trades occupations (odds ratio 1.20). Women with conceptual occupations, compared to their male counterparts, have a similar but still higher probability (odds 1.07) and a very similar odds ratio is presented by men in intellectual/managerial occupations. Men and women in unskilled professions have a perception 10% and 30% lower than the reference category.

Among the contract typologies the higher exposure is reported by fixed-term employees with 43% more than permanent employees, and self-employed persons 25% more. Being a private employee also affects the probability almost 50% more than being a public employee (CI 95%: 1.41-1.55). Working in small and medium-sized enterprises protects against psychological risk factors: 20% and 10% respectively. Full-time worker were 28% more likely than those chose part-time.

The probability of being exposed to psychological risk is significantly higher for people in the middle age group, for those with a tertiary education for Italians and for residents in in the North-East.

Figure 3 – *Exposure to at least one psychological risk factor by occupations and gender, firm size, contract type working hours. Odds ratio.*
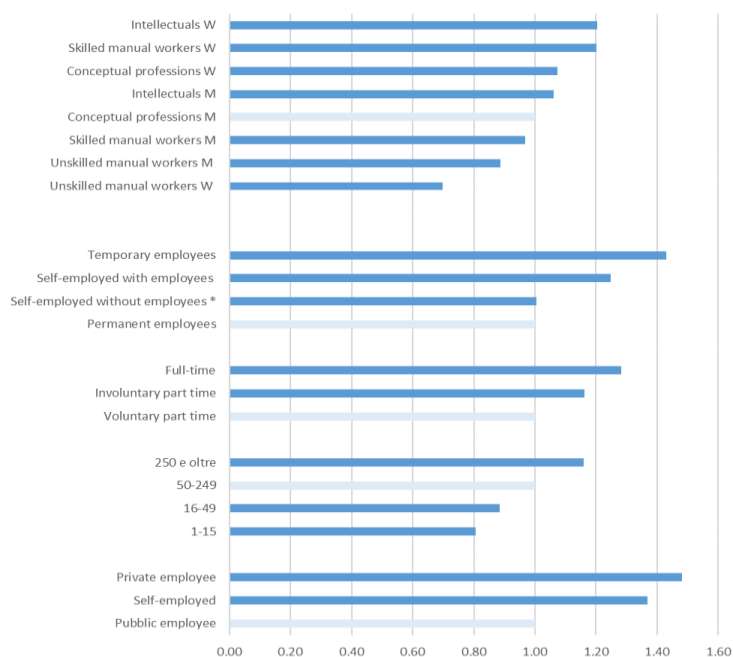
Source: Labour Force Survey: Ad Hoc Module 2020.

To deepen the analysis, the model was applied to three specific risks (dependent variables) on which to investigate the different propensities of the employed, based on belonging to one of thirteen occupational groups, stratified by gender and adjusted for socio-demographic confounding variables. The first risk factor taken into account is being exposed to a to severe time pressure or overload of work: for both genders the health occupations are the most exposed to this risk factor. Among men, the health employed feel this risk factor 1.46 (95% CI: 1.20-1.77) times more than white-collar workers, taken as the reference category; the entrepreneurs and managers in public administration 1.36 (95% CI: 1.12-1.66) times more (figure 4). they are followed by management, legal and cultural specialists and technicians; trade and restaurants workers and the employed in STEM professions. The least exposed to excessive workload were unskilled workers (odds ratio 0.75; 95% CI: 0.59-0.95) and metal and building workers (odds ratio 0.79; 95% CI: 0.68-0.91).

Figure 4 – *Exposure to time pressure and overload by occupations and gender. Odds ratio.*
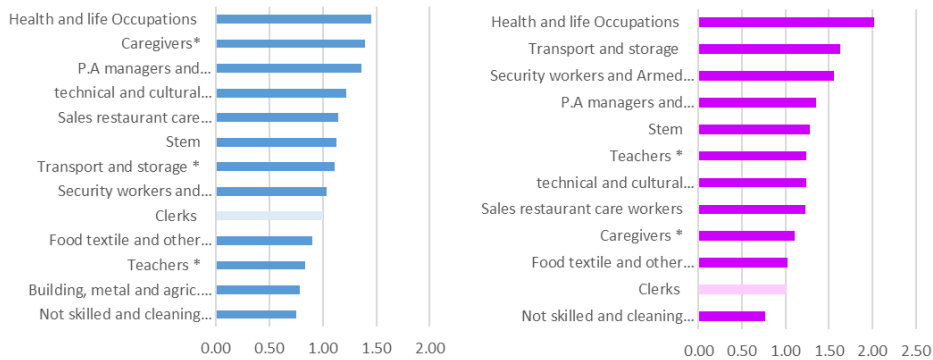
Source: Labour Force Survey: Ad Hoc Module 2020.

Women employed in the health and life sciences professions, such as doctors, pharmacists, nurses, social workers, are more than twice as likely to be exposed to an excessive workload compared to female clerks (odds ratio = 2.02; 95% CI: 1.76-2.32). This is followed by female workers in the transport and storage sector (odds ratio 1.63; 95% CI: 1.12-2.33), those in the security and armed forces sector (odds ratio 1.56; 95% CI: 1.08-2.23) and in the STEM area (odds ratio 1.28; 95% CI: 1.05-1.56). On the other hand, female workers in the unskilled occupations show a lower risk propensity (odds ratio 0.77; 95% CI: 0.62-0.94). The probability of being exposed to bullying or harassment in the workplace is more than four times higher among men in the armed forces or security than among office workers. (odds ratio 4.37; CI 95%: 3.18-6.05). Doctors, nurses and healthcare workers are also exposed to these risks more than three times as much as white-collar (odds ratio 3.34; 95% CI: 2.34-4.81). This is followed by transport and storage workers (odds ratio 2.16), unskilled workers (odds ratio 1.90) and trade and catering workers (odds ratio 1.73). Among women, the most exposed to this risk, respect the office workers, are security and armed forces workers (odds ratio 3:43; 95% CI: 2.11-5.41) , the employed in health occupations (2.4 ; 95% CI: 1.91-3.02;). For all other categories there are no significant differences in the perception of this specific risk. The third psychological health risk factor considered is to deal with difficult people such as patients, clients, students... Exposure to this risk is highest among 'contact' professions for both genders. Among men, the most exposed are those employed in the health and life sector: odds ratio 2.70 (95% CI: 2.22-3.29), followed by caregivers (odds ratio of 2.43) and security and armed forces workers, who are twice as likely as office workers (figure 5). Teachers and those employed in commerce and restaurants are also significantly exposed to this risk.

Figure 5 – *Exposure to "deal with difficult people" by occupations and gender. Odds ratio.*
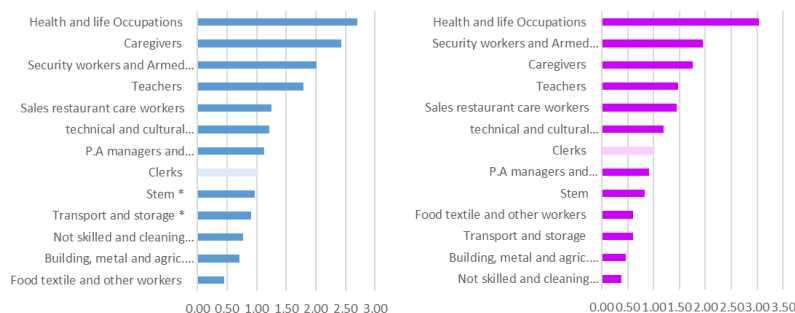
Source: Labour Force Survey: Ad Hoc Module 2020.

Even among women, who, as mentioned, are prevalent in the care and teaching professions, the most exposed professions are those in the health care sector, who are three times more likely to be exposed to this risk factor than office workers (95% CI: 2.64-3.48). security workers are twice as likely, followed by carers (odds ratio of 1.76; 95% CI: 1.39-2.20) and teachers (odds ratio of 1.47; 95% CI: 1.27-170). It is evident from the above results that those employed in the health professions are the most exposed to psychological health risks. Naturally, the occurrence of the Covid-19 Sars pandemic emergency during the collection year accentuated the occupational health and safety problems of these workers. They were exposed more because of their greater workload, but they were among the most exposed also in previous surveys. A focus on them shows that female nurses and therapists are the category most exposed: 1.42 times more likely than their male colleagues (IC 95%: 1.12-1.80).

4. Conclusion

The data of the Istat ad hoc module of 2020 on health and safety at work, together with the information from the Labor Force Survey in which this module was inserted, are an important source for investigating gender differences related to this dimension and to provide information for planning prevention activities which take into account gender differences. A fundamental and unavoidable aspect is the occupational vertical and horizontal segregation for which different tasks entrusted to men and women can entail different exposures to risk. By adopting a classification that considers the sector and function of occupation and going into the detail of the different risk factors, this study highlights that timing and excessive workload, difficulty in dealing with clients and patients, bullying and

harassment are factors particularly felt by women. The work contexts in which women are more likely to be exposed to risk factors for psychological health are those with a strong relational content. Having to deal with difficult people are particularly felt by teachers and shop assistants/restaurateurs but above all by health workers. Also, for bullying and harassment, health is the area most affected along with occupation in the safety. The pandemic has put pressure on the health system and health professions, where women are the majority especially among nurses. Data used in this study testify to this situation. Women show a higher probability of exposure to psychological risks (+ 30% more than men), especially nurses and those working in larger settings and among employees in the private sector. A comparison with the data of the next ad hoc module will make it possible to make a comparison between the period of the pandemic and the post-pandemic. Future developments of a gender approach in health and safety should consider the intersection of gender with other characteristics and therefore intersectional risks that are not the sum of exposure to multiple characteristics (e.g., gender and citizenship; gender and sexual orientation) but refers to a different "qualitative" experience not visible if analysed in a single-category perspective. A gender-sensitive approach should also overcome a cisgender and binary conception of gender. Risks related to the experience of trans people and non-binary identities within work environments permeated by a cis-regulatory and heteronormative organizational culture should be considered. Finally, a further aspect partly linked to the previous ones, is the importance of discrimination and working climate as a dimension of health and safety at work considering both the more tangible forms and the less tangible forms (De Rosa *et al.*, 2022) such stereotypes and microaggressions (Sue, 2010).

References

ARTAZCOZ L., BENACH J. BORRELL C., CORTÈS I. 2005. Social inequalities in the impact of flexible employment on different domains of psychosocial health, *Journal of Epidemiology & Community Health*, Vol. 59, No.9, pp.761-767.
BARIGOZZI F., MONTINARI N. 2022. Tanti "perché" per i divari di genere nel mondo del lavoro, *lavoce.info*.
BONDE J. P. E. 2008. Psychosocial factors at work and risk of depression: a systematic review of the epidemiological evidence, *Occupational and environmental medicine*, Vol. 65, No. 7, pp.438-445.

BONGERS P. M., de WINTER C. R., KOMPIER M. A. & HILDEBRANDT V. H. 1993. Psychosocial factors at work and musculoskeletal disease, *Scandinavian Journal of Work, Environment & Health,* Vol.19, No. 5, pp.297-312,

BOSCHETTO B., DE ROSA E., MARINI C. 2016. Work-related stress and associated factors: a comparison before and during the economic crisis. *Rivista Internazionale di Scienze Sociali,* Vol. 124, No. 3-4, pp.283-300.

BOSCHETTO B., DE ROSA E., MARINI C., SALVATORE A. 2017. Safety at Work in Italy: A Comparison of Italians and Foreigners, *Espace populations sociétés* No 3.

COLLINGWOOD S. 2011. Attitudes to health and work amongst the working-age population. *Research Report N 763*, Department for Work and Pensions. London.

DE ROSA E., de MARTINO V., NUR N., SCAMBIA F. 2022. Perspectives on LGBT+ working lives: stakeholders, employers and LGBT+ people. LVIII Riunione Scientifica della SIEDS.

DOMINIQUE A., FRANZ C., KÜMMERLING A. 2013. *Working time and work–life balance in a life course perspective*, Dublin: Eurofound.

FARRIS S. R., BERGFELD M. 2022. Low-skill no more! essential workers, social reproduction and the legitimacy-crisis of the division of labour, *Distinktion: Journal of Social Theory*, pp.1-17.

GIAMMARIOLI, A. 2017. Salute e sicurezza sul lavoro. Il genere fa la differenza. *InGenere.it.*

INAIL 2021. Infortuni e malattie professionali. *Inail.it.*

ISTAT 2021a, Comunicato stampa Il mercato del lavoro. IV trimestre 2021. *Istat.it*.

ISTAT 2021b, Rapporto annuale 2021. La situazione del paese. 2021. *Istat.it*.

ISTAT 2021c, Eurostat, Salute e sicurezza sul lavoro-Anno 2020/2021. *Istat.it*.

THEORELL, T., KARASEK, R. A., ENEROTH, P. (1990). Job strain variations in relation to plasma testosterone fluctuations in working men-a longitudinal study. *Journal of internal medicine*, Vol. 227, No. 1, pp. 31-36.

JONES M. K., LATREILLE P. L., SLOANE P. J., & STANEVA A. 2011. Work-related health in Europe: Are older workers more at risk? *IZA Discussion Paper.* Institute for the Study of Labor (IZA), Bonn.

LEKA S., JAIN A., & World Health Organization. 2010. Health impact of psychosocial hazards at work: an overview, *Institute of Work, Health & Organisations*, University of Nottingham.

LUTHANS F., AVOLIO B. J., AVEY J. B., NORMAN, S. M. 2007. Positive psychological capital: Measurement and relationship with performance and satisfaction, *Personnel psychology*, Vol. 60, No. 3, pp. 541-572.

SUE, D. W. (2010). *Microaggressions and marginality: Manifestation, dynamics, and impact*. Hoboken: John Wiley & Sons.

SUMMARY

Despite the improvement in the female employment rate in recent years, up to the 2020 pandemic crisis, gender gaps in the Italian labour market are still evident, if not more pronounced following the Covid-19 pandemic. However, women's disadvantage is not only measured in the levels of employment and unemployment, but also in the type of occupation performed. In 2020, 50.9% of female employment is concentrated in only 19 occupations (men in 51 occupations). The different structure of male and female employment, with the strong horizontal and vertical segregation of women, has effects on occupational health and safety conditions at work. A gender approach is certainly useful in highlighting the peculiarities of certain work contexts and types of occupations. The aim of this study is to analyse the different likelihood of males and females to become ill with stress, depression or anxiety for work-related reasons and to perceive psychological health risks by investigating certain occupational groups, the created "job families' such as management and entrepreneurial occupation, health occupations, those in the security or trade sectors. The analysis is based on data from the ad hoc module 'Health and safety at work' included in the Labour Force Survey in the year 2020. The module collected information on accidents at work, health problems and perceptions of various risk factors for physical and psychological health in the workplace. It emerges that female workers are more critical than male workers for certain occupational groups. Overall, women suffer significantly more from stress than men and are more exposed to psychological health risk factors. In particular, women workers in healthcare, transport and storage, security and businesswomen and managers in public administration. Among the psychological risk factors for these categories, excessive workload, having to deal with difficult people, such as clients, patients and students, and being bullied or harassed are particularly felt. Above all highlighted are the unsafe conditions for psychological health in the health professions, particularly affected by the pandemic, where female disadvantage is even more pronounced.

_____

Barbara BOSCHETTO, Istituto Nazionale di Statistica, boschett@istat.it
Eugenia DE ROSA, Istituto Nazionale di Statistica, eugenia.derosa@istat.it
Antonella IORIO, Istituto Nazionale di Statistica, antonella.iorio@istat.it

CHILD BRIDES IN XIX CENTURY ITALY:
THE CASE OF MONTALLEGRO (AG)

Giuliana Freni

1. Introduction

The expression 'child brides' is a relatively recent term which normally refers to a child or a teenage girl joined in a marriage with a groom often (but not always) much older. Currently, this kind of unions (involving a minor under the age of 18) is widespread in many countries. The highest levels of child marriage are recorded in West and Central Africa, where nearly the 40% of young women were married before age 18. The practice is present with lower levels in Eastern and Southern Africa (32%), South Asia (28 %), and Latin America and Caribbean (21%)[1]. However, marriage unions involving minors represented a practice that always existed in all over the world and over time and perhaps was still present in some Western European countries at least until up to the 1960s. The dignity and protection regarding childhood and adolescence nowadays, at least in European and North American context, has resulted from a recent awareness and inevitably influence our judgment towards a practice that is now considered 'uncivilized'. There is an extensive literature devoted to the history of marriage and family (Goody, 1983; Duby, 1991), their evolution over time and the structures assumed: neolocality or patrilocality, monogamous or polygamous marriage (Herlihy, 1985) and the patterns established in different geographical contexts (Hajnal, 1965; De Moor and Van Zanden, 2010). There has been no shortage of studies focusing on the Italian context in the same period considered in the present work (Barbagli, 1987; Rettaroli, 1990; Derosas et al., 2014; Caltabiano, 2020). However, up to now, very little evidence exists regarding young brides in the past both within Italian and European perspective, their social origins, and the norms regulating such practices. In the attempt to reconstruct the history of child marriages scattered throughout the broader literature on marriage and family mentioned above, it was possible to identify some common factors promoting very low age at marriage. First of all, a young bride is a guarantee of higher fertility, chastity and certainty of offspring. Secondly, a young and inexperienced mind is more easily conditioned,

---

[1] UNICEF global databases, 2022 https://data.unicef.org/topic/child-protection/child-marriage/.

consequently a young girl would bend without difficulty to the will of the parents and the groom. Another, but no less impactful factor was, and in many countries still is, the dowry or the bride price: younger is the bride, lower will be the dowry her parents have to offer or higher will be the bride-price they will receive in exchange (Botticini and Siow, 2003; Anderson, 2007). While other determinants potentially related to this practise were (and are) life expectancy, institutional factors, economic system, religion, 'collective crisis' like war, famine, disease, and environmental disasters (Bell, 1979; Ahmed et al., 2019; Corno et al., 2020). In some European countries, including Italy this phenomenon, strictly linked to the practice of forced marriages, is re-emerging as effect of immigration from Pakistan, Nigeria, Bangladesh and communities belonging to the Roma ethnic group. A better understanding of the dynamics behind these marriage practices, is indispensable to deal with them. This paper aims at investigating early marriage patterns in nineteenth-century Italy within circumscribed territorial contexts. The "child brides" here considered are young teenagers between the ages of 12 and 15. The paper is structured as follows: after the introduction, the second section briefly outlines the socio economic picture of the Sicily at the time; the third section provides an overview of child marriages diffusion at the national and regional level, the fourth section focuses on source description and the fifth one is dedicated to child-bride marriages in Montallegro, finally a short conclusion proceeds.

2. Sicilian socio economic -context in XIX century (1815-1876)

After the Napoleonic interlude, King Ferdinand I of Bourbon regained possession of the Kingdom of Naples, while in Sicily it was set up a Commission for the Rectification of the Constitution of 1812, whose importance lies in its attempt to create a parliament on the English model and the abolition, at least at least in law, of feudalism. However, after 1815, as well as before the constitution, the Sicilian population could basically be grouped into two classes: a narrow class of very wealthy landlords, the other, including almost all the rest of the population, made up of illiterate and null peasants who were often day laborers. Those who did not fall into either class were only a few small-town merchants, craftsmen and a few small-to-medium landlords. (Franchetti and Sonnino, 1877). This social composition is perfectly reflected in the village here considered, Montallegro. Acute social inequalities were joined by not a few problems of security and crime specially in some provinces (Bonfadini, 1876) In fact, as observed by Franchetti and Sonnino in their report on the condition of Sicily after Italian reunion, despite some common features, the island showed many social differences from a geographic area to another. The area more disadvantaged used to be the central

section of Sicily from the Tyrrhenian to the southern coast (with the exclusion of the eastern and western areas), characterized by latifundia, desolation and more difficult internal connections. Following this classification, the little municipality of Montallegro belongs to this area. Here the economy was based on graniculture alternating with natural grazing and fallow land. Peasants' conditions were particularly hard, having to travel many kilometres to reach the work camp they often slept rough and away from their families who remained near urban centres. Consequently, women remained didn't participate in the agricultural works except during the periods of harvesting crops, grape harvest and olive or hazelnut harvest. Women from poorer families usually joined these activities, outside of that, women always stay at home, spinning flax, tending pigs and babies. In contrast, in the oriental area of the island women used to be more involved in agriculture including work away from home. (Franchetti and Sonnino, 1877). Another key element of the economy of inland Sicily was sulfur mining as witnessed by the numerous mines in the provinces of Agrigento, Caltanissetta and parts of Palermo and Catania. In these mines, men, boys and solely even girls used to be in a dreadful state especially because of the poor hygienic conditions which favoured the spread of diseases, often lethal (Talamo, 1903) while the absence of strict rules from the government in the exploitation of sulfur might have favoured, according to some scholars, the rise of mafia power after the collapse of the Bourbon Kingdom (Buonanno et al., 2015).

3. Child Marriage in Italy (1861-1871)

This study employs the 1861 and 1871 Italian general population censuses to observe the dimension of child brides' marriage at different levels (national, regional, and provincial). The decree establishing the Statistical Service of the newly unified Kingdom of Italy was issued in October 1861 by Filippo Cordova, former director of the office of General Statistics of the Kingdom of Sardinia (Favero, 2012). The census of 1871 realized 10 years after the first one, as the latter, considered legal population the present inhabitants at that moment in all the 69 provinces into which the kingdom was divided, 10 more than the previous census which did not include Veneto and Lazio yet. However, even though it regards a still incomplete Kingdom, the 1861 census represents a sort of "bridge" and takes a picture of Italy during a delicate socio-political transition in which institutional elements of the previous restoration States still regulated important aspects of civic life. Counting for each province the number of girls aged 12-15 already married at the time of the first census (Figure 1), emerges a clear concentration of the "phenomenon" in the southern regions of the country,

Northern Calabria, Basilicata and especially in the southern part of Sicily corresponding to the current provinces of Catania, Siracusa, Enna, Caltanissetta and Agrigento. Northwest regions, Sardinia and Apulia are affected to a lesser extent, while the lowest numbers are recorded in central, and the northern Italy. The second census shows a sharp decline in the south and an almost unchanged picture in the central and northern regions and in Sardinia. The numbers in Sicily remain high, but they affect a more circumscribed area related to Caltanissetta and Agrigento provinces. This latter records the highest percentage, for this reason this study is centred on a municipality belonging to this province.

Figure 1 − *Number of 12-15-years-old brides per 10.000 inhabitants.*
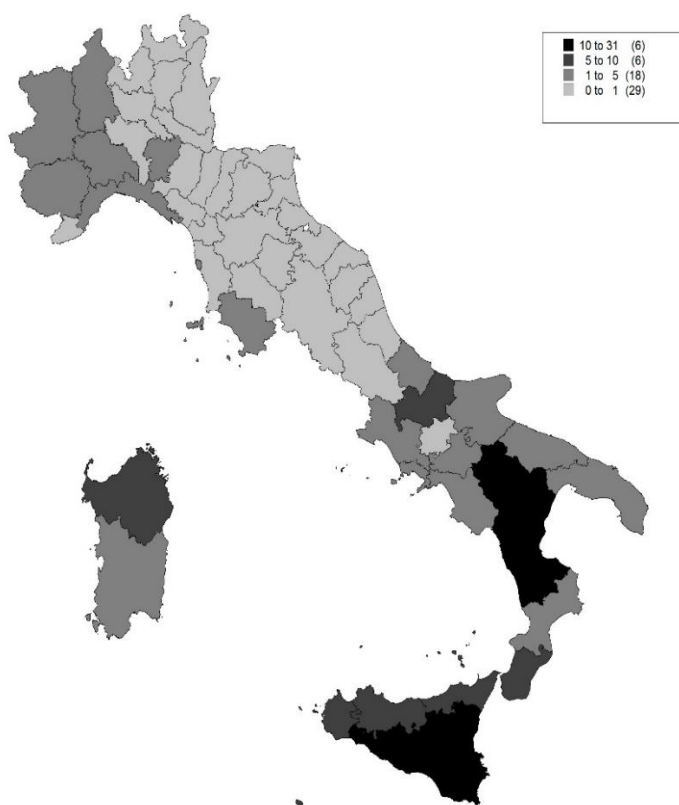
Source: Italian Census 1861

4. The Sources: *I Registri dello Stato Civile della popolazione* (1819-1865)

The main source here employed is represented by the *Registri dello Stato civile* of the restoration period adopted by Kingdom of the Two Sicilies in 1819 in place of the Napoleonic Code (Sciarra, 2016) and remained valid until 1865 (during the first four years of the new State) after which they were replaced by the new Civil Code Pisanelli (1866). In the *Codice per lo Regno delle Due Sicilie,* inspired by the French model, the life events were divided in three different registers: births, deaths and marriages. Chapter Three of Title II of the Code contains instructions for the correct compilation of marriage acts. These deeds have to include the following information: names of both brides and grooms, their age and profession (for grooms), birthplace and domicile of both; whether they have reached the age of majority; whether they have already been married; names, professions and domicile of their respective parents and wedding witness; parental consent or failing that of their paternal ancestor or family council; the solemn promise of the bride and groom to celebrate the marriage in the face of the Church, in accordance with the forms prescribed by the Council of Trent (*Codice del Regno delle Due Sicilie del 1819*). In addition, depending on the presence or absence of the signatures at the bottom of the act, it is possible to infer if the spouses, and their parents, were literate or not. Ceremony was preceded by the civil engagement of get married within one year in front of the Mayor or a civil registrar of the municipality to which they belong. A copy of the act of marriage was delivered to the priest who had to celebrate it and then again to the civil registrar. Without civil promise, the marriage was only valid for the church (Caltabiano, 2020). In other words, the civil efficacy of the marriage required the religious rite and so it was until the adoption of the new Pisanelli Code which succeeded in secularizing the institution of marriage (Sciarra, 2016). The Chapter I of Title V (*Del Matrimonio*) is dedicated to the necessary conditions and requisites for marriage. The minimum age for contracting marriage was 12 for women and 14 for men with parents' consent (the age of supposed acquired consent capacity for both sexes). There was another aspect that may have influenced age at marriage: the necessity of parental consent. Despite the age of majority was reached at 21 years for both women and men, only after 25 for men and 21 for women, parental and family approval was no more essential. The Code Pisanelli raised the marriage age to 15 for the bride and 18 for the groom and lowered the need for parental consent to 21 (*Titolo V, Capo I, Sezione I, del Matrimonio*) and from what emerges from the figures of the second census, it would seem to have played a role in reducing early marriages from the outset. To sum up, the registers of marriages of the Restoration Period provide a wealth of information useful for micro demographic studies based on individual data. All the registers regarding Montallegro are available in digital format on

www.antenati.san.beniculturali.it (Project *Antenati* supported by the *Ministero dei beni e delle attività culturali e del turismo*), together with the other municipalities of the province of Agrigento (and of almost the rest of the country). In this paper, historical series of all marriages celebrated in Montallegro from 1821 to 1865 are presented (registers of 1822, 1825 and 1844 are lost) focusing on brides' age at marriage along with their age difference with their spouses' age.

5. Nuptiality and Child Brides in Montallegro (1821-1865)

 Montallegro is a little municipality located in the southwestern area of the province of Agrigento. It develops mainly inland and has a short outlet to the sea. According to the first census of the newly formed kingdom of Italy, Montallegro used to have in 1861 a population of 1.626 inhabitants, 807 men, 819 women and a fairly high nuptiality rate in the same year 11,1 per 1000 compared with the national marriage rate in Italy the following year, 8.9 per 1000. Data referred to high nuptiality rate is consistent with what has been observed in more recent studies focusing on marriages in XIX century Italy confirming the association between latifundia, low ultimate celibacy and neolocal family in Sicily (Rettaroli, 1990; Cocchi et al., 1996).

Table 1 – *Mean values and Standard deviation concerning age at first and successive marriages in Montallegro (1821-1865).*

Mean Age	Bride	Standard Dev.	Groom	Standard Dev.
At first marriage	19,5	±5,3	25,2	±5,6
In remarriage	36,8	±11,3	41,7	±11,2
All	24	±10,5	29,7	±10,6

Source: Registri di Stato civile della Popolazione di Montallegro.

As you can see in table 1, the average age difference between bride and groom both at the first marriage and in remarriage and of the overall unions is always about five years within the classic hypergamous marriage typical of most couples (Giuliani, 2019).

Figure 2 – *Age at first marriage in Montallegro 1821-1865.*
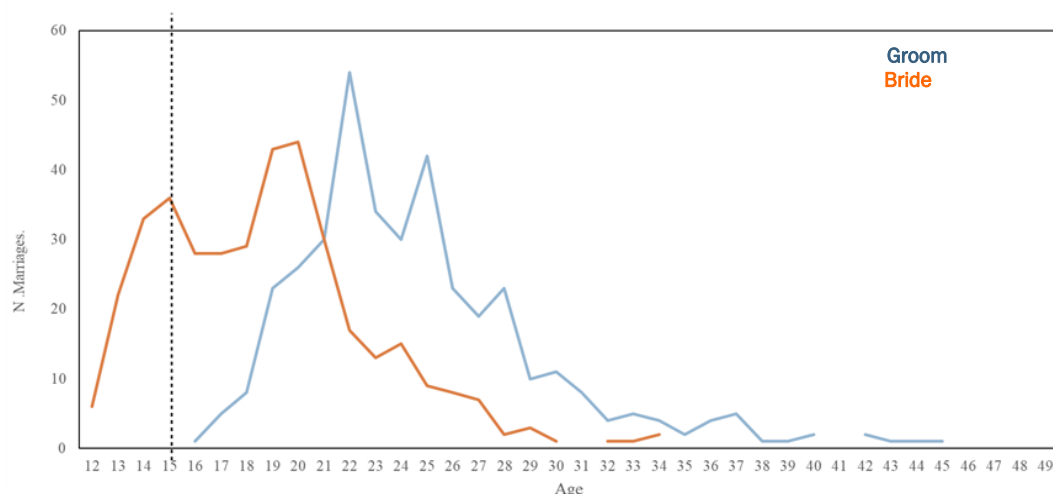
Source: Registri di Stato civile della Popolazione di Montallegro.

As it is possible to observe in Figure 2, in most part, the marriageable age for women ranges from 12 (presumably once they reach puberty) until 23-24, while the number of brides between the ages of 22 and 30 gradually decreases. From this age onward, with some exceptions, they were evidently considered out of the 'marriage market'. For men, entry and exit in the marriage market seems to be shifted about 4-5 years substantially mirroring the difference observed in Table 1. For grooms, frequency peaks are shown at 22, one year after having reached the age of majority and 25, age at which parental consent to marriage was no longer required (*Codice per lo Regno delle Due Sicilie, Titolo IX and Titolo XI).* The same consideration cannot be made for women, probably because they still had less decision-making power despite their legal status. However, for both men and women, in this little municipality belonging to a latifundia area with high need for wage labor, age at first marriage was lower than in other predominantly sharecropping Italian regions in XIX century where families were engaged in direct farm management (Cocchi et al.,1996). The occupations of the spouses and/or their parents transcribed in the records of marriage reflect the socio-economic structure described in section 2 regarding this inland and southern part of Sicily in which most part of the population was employed in agriculture, to a lesser extent in animal farming and in the mines present at the time in the neighbouring territories. Given the small number of ranchers and miners, in Table 2 and in Table 3, these three 'sectors' are grouped together to represent the humblest socioeconomic class.

There was also a fair amount of traders and artisans and a wealthy class, identified in the registers with the terms 'borghese', 'civile' and 'gentiluomo' as well as 'possidente'. In Table 2 marriages including child brides are grouped by social class by taking into consideration the groom's profession. It would have been more correct to establish the bride's social group by referring to her father's occupation, but unfortunately this information is not always reported in the records, especially in the cases in which the father is dead. However, where present, the father's profession is almost always the same of the son-in-law. In other words, we are dealing with homogamous marriages, namely unions between members of the same social group, as observed in other Sicilian contexts of the same period (Caltabiano, 2020).

Table 2 – *Groom's professional field and child brides (Montallegro1821-1865)*

Groom's professional field	Number of marriages	Brides-aged 12-15	% brides 12-15
Agriculture, Farm and Mine	466	67	14,3
Craft and Trade	81	17	20,0
Upper Class	162	41	25,0
Other (unreadable)	8	0	0,0
Total	717	125	17,4

Source. *Registri di Stato civile della Popolazione di Montallegro.*

As we can observe in Table 2 the highest percentage of child brides is not found among the marriages of the supposed poorest social stratum, but among the 'upper class'. It would seem that in this static socio-economic framework local élites avoided 'mixing' with the subordinate classes by resorting to appropriate marriage strategies to keep their positions intact and continue to serve their interests. For this reason, it is possible to speculate that they did not hesitate to arrange children's marriages, easier if the children are younger, as customary among wealthy families until not so long time ago (Lombardi, 2008; Derosas et al., 2014). The other possible explanation is related to women's participation in the family economy. Being involved in the family's livelihood would induce parents not to give them away as brides too early and probably to enjoy greater freedom and less strong restriction in choosing a partner than their more affluent peers enclosed in a gilded cell and completely excluded from the economic affairs of the family (Fazio, 2004). This supposition would find possible confirmation in Table 3. We can observe that in all marriages, the average age difference increases from the humblest class (around 5 years) to the most affluent class (more than 7 years). Moreover, we observe the same trend in the marriages involving child brides with an even greater average age difference (from 8,7 years among the peasants until

more than 11 years among the wealthy class). Starting from the observation that, especially young people, tend to socialize mostly with peers, it seems difficult to assume that, unless exceptions, a couple with a large age difference has freely formed (Bell, 1879). Usually, the mothers of the future couple handled the negotiation, which could still end in a refusal by the girl (Pitrè, 1889). With reference to 12-15 -years- old brides, it is hard to explain their marriage to a 24-25 even 30-year-old man with a repair of a "romantic getaway" (*fuitina)* to oblige parents to accept the union to restore lost honour. In this regard, it useful to underline how in Mediterranean culture, and in Sicily in particular, the conception of "honour" strongly regulated social life (Schneider, 1971). Therefore, often maidens were forced to totally domestic life to preserve it, avoiding going out unless accompanied (Blok, 1974). For the same reasons just stated, it is difficult considering the marriages of these teenage girls to be the clumsy attempt to make up for a pregnancy already in progress[2].

Table 3 – *Groom's professional field and mean age difference between spouses in all marriages and in child marriages (Montallegro1821-1865)*

Groom's professional field	N° of marriages	mean age difference	Standard Dev.	Mean age diff. child-marriage	Standard Dev.
Agriculture, Farm and Mine	466	5,3	±9,8	8,7	±4,48
Craft and Trade	81	6	±8,9	8,7	±4,3
Upper Class	162	7,3	±8,8	11,4	±5,2
Other (unreadable)	8	7,4	±12	/	/
Total	717	5,8	±12	9,6	±4,41

Source: Registri di Stato civile della Popolazione di Montallegro.

6. Conclusion

The present study is a first attempt to investigate a marriage practice no longer belongs to Occidental culture. In XIX century Italy marriages involving young teenagers were still celebrated especially in the provinces of southern Sicily (Agrigento, Siracusa and Caltanissetta). Montallegro represents a first case study

---

[2] Cfr. BELL R. 1979. *Fate, Honor, Family and Village: Demographic and Cultural Change in Rural Italy Since 1800.* London: Routledge. In his study realized in the village of Nissoria (EN), the author cross-references marriage and birth data guarded by parishes (*Status Animarum*) to verify if the "child- brides" were pregnant at the time of marriage.

not just for the high number of child brides, but also for the high nuptiality rate indicating the tendency of widowers to remarry. Here, as in other Sicilian provinces, marriages were celebrated between people belonging to the same social class (homogamous marriages). A first key reading to explain the presence of marriages involving very young brides starts from their social belonging. Their high percentage among the 'upper class' in the period 1821-1865 can be justified by girls' absent contribute to the household economy and by marriage strategies aiming at maintaining their social status. In fact, with data and information available to us, and given the age difference with the spouses, it seems less credible to see these very young girls as the protagonists of romantic getaways then converted into marriage. Concerning poorer social strata, it cannot be excluded, that in few cases young girls were pushed into marriage by taking away from the paternal home another mouth to feed but we can certainly rule out that their marriage was expected to provide the quantum leap that would restore prosperity to the whole family since they were going as brides to a "colleague" of their father's. Finally, the persistence of the well-entrenched idea of "girl honour" as an asset to be protected to not ruin the reputation of the entire family might be a broader explanation to understand why these marriage practices persisted longer in some isolated communities in Sicily less exposed to external exchanges and contacts with other ways of life than in the rest of the country. The paper contains some partial findings regarding just one little municipality of Sicily, it is plausible to assume that by moving a few tens of kilometres different dynamics may emerge especially if we take in consideration the difficult communications at that time. For this reason, the present study aims at expanding in time and space and deepening the issues of social belonging and age differences between spouses within a broader geographic extent. Moreover, it will try to investigate new leads to get new answers, such as the impact of religion, hereditary system and the orphan status on child-marriages.

References

AHMED, K.J., HAQ, S.M.A., BARTIAUX, F. 2019. The nexus between extreme weather events, sexual violence, and early marriage: a study of vulnerable populations in Bangladesh, *Population and Environment*, Vol.40, No.3, pp. 303-324.

ANDERSON, S. 2007. The Economics of Dowry and Brideprice, *Journal of Economic Perspective,* Vol.21, No.4, pp. 151-17.

BARBAGLI, M. 1987. Sistemi di formazione della famiglia in Italia, *Bollettino di demografia storica*, Vol.5, No.2, pp. 80-127.

BELL R., 1979. *Fate, Honor, Family and Village: Demographic and Cultural Change in Rural Italy Since 1800*. London: Routledge.

BLOK, A. 1974. *The Mafia of a Sicilian village, 1860-1960: a study of violent peasant entrepreneurs*. New York: Harper & Row.

BONFADINI, R. 1876. *Relazione della Giunta per l'Inchiesta sulle condizioni della Sicilia.* Roma: Eredi Botta.

BOTTICINI, M., SIOW, A. 2003. Why Dowries?, *The American Economic Review,* Vol. 93, No.4, pp. 1385-1398.

BUONANNO, P., DURANTE, R., PRAROLO, G., VANIN, P. 2015. Poor institutions, rich mines: Resource curse and the origins of the Sicilian mafia. *The Economic Journal*, Vol. 125, No.586, pp. 175-2020.

CALTABIANO, M. 2020. Nuzialità, alfabetismo, ceti sociali a Messina nella prima metà del XIX secolo, *Popolazione e storia*, Vol. 21, No.2, pp. 53-70.

COCCHI, D., CRIVELLARO, D., DALLA ZUANNA, G., RETTAROLI, R. 1996. Nuzialità, famiglia e sistema agricolo in Italia, negli anni'80 del XIX secolo, *Genus*, Vol. 52, No. 1/2, pp. 125-159.

CORNO, L., HILDEBRANDT, N., VOENA, A. 2020. Age of marriage, weather shocks, and the direction of marriage payments. *Econometrica*, Vol.88, No.3, pp. 879-915.

DE MOOR, T., VAN ZANDEN, J. L. 2010. Girl power: the European marriage pattern and labour markets in the North Sea region in the late medieval and early modern period, *The economic history review*, Vol.63, No.1, pp. 1-33.

DEROSAS, R., BRESCHI, M, FORNASIN, A., MANFREDINI, M., MUNNO., C. 2014. Between Constraints and Coercion: Marriage and Social Reproduction in Northern and Central Italy in the Eighteenth and Nineteenth Centuries. In KUROSU S. and LUNDH C. (Eds.), *Similarity in Difference: Marriage in Europe and Asia, 1700-1900*, Cambridge MA, MIT Press, pp. 295-348.

DUBY, G. 1991. *Medieval marriage, two models from twelfth-century France*. Baltimore and London: The Johns Hopkins University Press.

FAVERO, G. 2012. Il dibattito sull'organizzazione dei primi censimenti unitari negli atti della Giunta e del Consiglio superiore di statistica, *Annali di Statistica*, Vol.12, No.2, pp. 121-145.

FAZIO, I. 2004. The family, honour and gender in Sicily: models and new research. *Modern Italy*, Vol.*9,* No.2, pp.263-280.

FRANCHETTI, L., SONNINO, S. 1877. *La Sicilia nel 1876*. G. Barbèra.

GIULIANI, G. 2019. The patterns of Age Differences Between Spouses in Italy, 1870-2015, in SAMOGGIA A. and SCALONE F. (Eds.) *La famiglia tra mutamenti demografici e sociali*, Udine: FORUM, pp. 163-172.

GOODY, J., GOODY, J. R. 1983. *The development of the family and marriage in Europe*. Cambridge: Cambridge University Press.

HAJNAL, J. 1965. European Marriage Patterns in Perspective. In D. V. GLASS and D. E. C. EVERSLEY (Eds.) *Population in History. Essays in Historical Demography. Volume I: General and Great Britain*, New Brunswick (U.S.A.): Aldine Transaction, pp. 101-143.

HERLIHY, D., HERLIHY, D. J., HERLIHY, D. V. 1985. *Medieval households.* Cambridge, MA: Harvard University Press.

LOMBARDI, D. 2008. *Storia del matrimonio. Dal Medioevo a oggi*. Bologna: Il Mulino.

PITRÈ, G. 1889. *Usi e costumi credenze e pregiudizi del popolo siciliano* (Vol.2). Palermo: L. Pedone-Lauriel.

RETTAROLI, R. 1990. Age at marriage in nineteenth-century Italy, *Journal of family history*, Vol.15, No.4, pp. 409-425.

SCHNEIDER, J. 1971. Of vigilance and virgins: Honor, shame and access to resources in Mediterranean societies. *Ethnology,* Vol.10, No.1, pp. 1-24.

SCIARRA, F. 2016. Il matrimonio nell'Ottocento italiano fra potere civile e potere ecclesiastico, *Historia et jus. Rivista di storia giuridica dell'età medievale e moderna*, Vol. 9, No.21, pp. 1-14.

TALAMO, S. 1903. Le zolfare e i zolfatari di Sicilia, *Rivista Internazionale di Scienze Sociali e Discipline Ausiliarie*, Vol. 31, No.123, pp. 353-371.

SUMMARY

While the Italian and international literature on marriage and family investigated the evolution of family and marriages over time, few attentions have been paid to the history of child marriage in Italy and Europe. Based on the employment of a source still little used in demographic studies, the register of marriage acts of the Kingdom of the two Siciles (contained in the Registri dello Stato Civile della Popolazione), this article attempts to investigate the early marriage patterns in nineteenth-century Italy (period 1821-1865) focusing on Montallegro, little municipality belonging to the province of Agrigento. Although, child -marriage was practised in all social classes, the higher percentage, together with a larger mean age difference between spouses, is found among the 'upper class'.

_____

Giuliana Freni, Università degli Studi di Sassari, g.freni@studenti.uniss.it

AN EMPIRICAL TAKE ON THE ECONOMIC EFFECTS OF INSULARITY: THE ITALIAN REGIONAL CASE [1]

Marina Cavalieri, Daniela Di Pasquale, Benedetto Torrisi, Gianpiero Torrisi

1. Introduction

The development of a territory depends on various factors such as competitive capacity, the degree of schooling, centrality with respect to developed contexts, and territorial positioning. What happens when all these factors interact in an 'island' context?

This issue is still under debate and the extant literature reports mixed evidence with pros and cons of insularity. For example, Fellmann (2020) highlights how insularity is potentially an advantageous factor. However, the potential benefits may depend heavily on the territorial positioning in a fairly developed context in terms of competitiveness and socio-economic development. Such aspects should be taken into account when comparing the islands she mentions such as Gotland or Bormon, in Denmark, with, for example, the two largest Italian islands: Sicily and Sardinia. Indeed, it has already been pointed out in the literature how insularity can be considered a phenomenon of permanent economic and social peripherality that structurally hinders the development and the achievement of specific objectives that are more easily attainable by benefiting from territorial continuity.

Deidda (2014) highlights how insularity, as a condition of distance from the nodes or pivots of the development of commercial interactions, determines an increase in costs - including, but not limited to, those related to distance - with a consequent decrease in economic competitiveness with negative effects also on overall productivity. Cocco *et al.* (2018) point out the importance for those who run a business to be located in a networked territorial environment on the mainland by taking advantage of the proximity of their customers or distribution centers; in addition, their analysis shows how in some instances insularity is a condition of

---

peripherality and remoteness that restrains the development of the production system and negatively affects the welfare of consumers.

The debate arising from the comparison of the various contributions, therefore, highlights the strengths and weaknesses of the effect of insularity on economic performance. Building upon this debate, this contribution aims to analyze the spatial uneven effects of trade Italian regions controlling for their competitiveness and (the costs of) their distance.

The analysis fails to detect such a generalised insularity effect. Though, a negative and statistically significant impact of insularity is detected specially for Sicily. We interpret this result in the sense that potentially negative effects of insularity depend on place-specific characteristics.

2. Distance and competitiveness

This analysis refers to the EU regions (268 at NUTS2 level) for which the transportation costs are considered based on the prevalence of the method. More precisely, road transport, followed by rail and finally waterways[2].

Eurostat calculates the average Generalized Transport Costs (GTC) of all recipients for each region as an inverse measure of accessibility. As shown, geographically central regions have the lowest transport costs due to their central location within the road network, while peripheral regions generally suffer from higher transportation costs.

When analyzing the breakdown of the cost of transport, 60% can be attributed to time and fuel. The cost of time is composed of the value of wages and the value of rest time. While distance costs are determined by fuel prices and fuel consumption. Other relevant cost components are related to maintenance, insurance, financing, depreciation, and indirect costs, which count for around 40%. Eurostat calculates even the breakdown into the two main components of 'distance' and 'time' shows a marked heterogeneity between regions (*Distance and time related costs of GTC for each NUTS 2 region distance-related costs and time-related costs*).

An alternative cost estimation strategy to the one considered so far is to weight the cost measures between regions *i* and *j* by the bilateral trade flow between regions *i* and *j* using the data provided by Thissen et al. (2019). In reports those weighted transportation costs. It makes the marginality of some regions more apparent.

---

[2] The figures recorded in 2016 were 76.4 percent and 23.6 percent of total freight by road and rail and waterways, respectively. European Commission (2019) Estimating road transport costs between EU regions in JRC Working Papers on Territorial Modelling and Analysis No 04/2019.

Even from a more general perspective than focusing on transport costs, it emerges that the competitive capacity of regions shows similar patterns. This is evident from the Regional Competitiveness Index (RCI).

Hence, we can affirm that the two islands on which this work focuses (Sicily and Sardinia (Biagi *et al.*, 2019), from a descriptive point of view, are characterised by a marginal position not only from a merely geographic point of view, but also from the point of view of transport costs and, more generally, of territorial competitiveness. A more detailed analysis will be offered below to verify the effects of this marginality on their economic performance.

3. Data and empirical strategy

As aforementioned, we consider transportation costs for EU regions (268 at NUTS2 level) calculated according to the criterion of the prevalence of the type of transport recorded. The dataset reports estimates of the different distance measures between the EU regions at NUTS2 level calculated considering both distance (road and geodetic (line segment)), road time (truck), and cost estimates. More specifically, averages of distance measures between centroids were calculated for each pair of regions in relation to variables such as total fuel consumption, tolls, wages, and taxes[3].

Using the above distance cost data, the impact of exports on the GDP of Italian regions was estimated using a Random Coefficients Model (RCM). However, the original (export-based) model, based on well-established literature dating back to the 1950s (see, among others, the important contributions of North (1955) and Tiebout (1956)) was augmented control for the specific effect of distance (i.e., its cost). In formula (1)

$$GDP_i = \beta_{0i} + \beta_{1i}Export + \beta_2 Distance + \beta_3 Export * Distance + u \qquad (1)$$

In which the variable 'GDP' refers to regional GDP, the variable 'Export' represents the total exports of the Italian regions, the variable 'Distance' represents the total cost of the distance between each Italian region and its trading partner, and the variable 'Export*Distance' their interaction. Note, how the estimation of a random coefficient model allows for the identification of possible variations in the impact of exports - controlling for distance - at the level regional level (Singh and Ullah, 1974).

---

[3] For the details about the methodological aspects the reader is addressed to European Commission, 2019.

The GDP variable is reported in millions of euros and transformed into a logarithm; exports are reported in tens of millions of euros. Further, to estimate the model with reference to the Italian regions (NUTS 2), it was necessary to calculate the average at the same level of geographical aggregation (NUTS 2) of the costs of the relative distances to the destination regions. This was done for all export destination regions of the Italian regions.

Moreover, to make the estimates more readily interpretable, all distance measures have been centered with respect to the average. In fact, as is well known, when the interaction term is added to an estimate, in the terms of our model, a one-unit increase in exports will not produce an average change in GDP equal to the value of its coefficient. Indeed, the marginal effect of exports on GDP now varies according to the level of the 'distance' variable. More precisely, the marginal effect of exports will be equal to their coefficient plus the coefficient of the interaction term times its interaction with the distance variable.

Table 1 – *Export-based model*

VARIABLE	GDP	*p-value*
Export	0.256***	(0.00780)
Distance	-4.88e-07	(1.25e-06)
Distance x *Export*	3.56e-05*	(2.03e-05)
Obs.	4,760	
No. of Groups	20	

Source: authors' elaboration. Notes: * denotes statistical significance at 10%, ** denotes statistical significance at 5%, *** denotes statistical significance at 1%. The variable 'Distance' refers to total distance costs centred on the mean value. The variable 'Export' was reported in tens of millions of euros; The variable 'GDP' was reported in logarithm.

Thus, the only case in which the variable 'distance' does not affect the marginal effect of exports on GDP is when the value of the distance is zero. However, this result is not relevant due to its economic interpretation. For this reason, as mentioned, the distance variable has been centered on its mean value. By doing so, the coefficient of exports will provide their marginal effect on GDP for the average level (of cost) of the distance between each Italian region and its trading partner.

The results of the above model estimation are shown in table 1. Thus, the preliminary estimates in table 1 confirm a statistically positive impact of exports on economic performance. More precisely, the coefficient reported (0.256) shows that a unit increase in export w.r.t. the mean value has a 25.6 unit effect on GDP. Put another way, a one-million deviation of exports from the mean has an estimated effect on GDP of 2.56 million. Although this is a preliminary estimate, this result - which, as mentioned, controls for the distance between the regions involved in the trade in question - confirms the crucial role that exports play in the economic

performance of the Italian regions. Likewise, the interaction term between exports and distance shows a positive and statistically significant coefficient. Although of a negligible magnitude. Distance per se, however, is not statistically significant.

In addition to the indications of the significance of the coefficients, the previous model provides insights into the potential spatial differences in the effects of export at the regional level. Indeed, by decomposing the coefficient for export (β_{1i}) into its components ($\beta_{1i} = \beta_1 + \gamma_i$), one can detect the spatial heterogeneity in the effects of exports on GDP. Figure 4 reports the spatial distribution of RCs across the 20 Italian regions.

Figure 1 shows that although we do observe spatial differences in the effects of exports on GDP. More precisely, the negative values for the random coefficients (γ_i) can be interpreted in economic terms as follows. With respect to the overall positive effect of the exports on GDP, each region suffers from a kind of penalty due to local conditions which seem to be generally higher for northern regions than for the southern ones. We conjecture that this penalty is, at least partially, linked to the extent to which the region is engaged in external trade which is generally higher in the North.

Figure 1 – *Random Coefficients for Export.*

Random Coefficients for Export

(-.1914283,-.1560856]
(-.197318,-.1914283]
(-.2153801,-.197318]
[-.2359002,-.2153801]
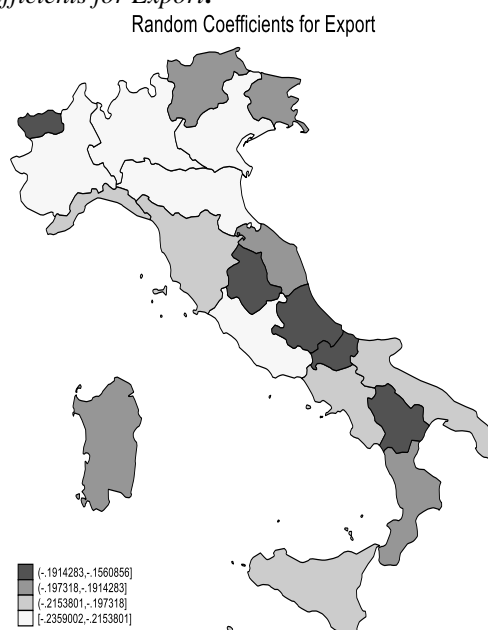
Source: authors' elaboration.

For example, ISTAT (2022)[4] reports that in the first trimester of the current year, on an annual basis, the greatest contributions to the year-on-year growth of national exports come from the increase in sales from Lombardy to Germany (+30.3%), the United States (+38.5%), France (+19.3%) and Spain (+28.2%), and from Emilia-Romagna and Friuli-Venezia Giulia to the United States (+79.5% and +301.8% respectively), the latter being influenced by sales of maritime shipping. Therefore, Northern regions suffer most from this structural gap. In order to further explore this issue, we run an additional regression of estimated RCs against the regional competitiveness factors as captured by the RCI.

The analysis is augmented with a dummy variable for Sicily and Sardinia (D_island) aiming to capture the potential presence of an "island effect". The results are reported in table 2.

Table 2 shows that our empirical analysis fails to detect such a generic island effect. However, by considering two separate dummies for Sicily (D_Sic) and Sardinia (D_Sar), the former is negative and statistically significant at 10%. Results are reported in table 3.

Therefore, although the hypothesis of a generalized negative effect of insularity must be rejected based on the current analysis, a negative effect of isolation is detected for Sicilian Island. Undoubtedly, this result calls for further analysis exploring the causes as well as the main drivers of such evidence. Nonetheless, it is worth stressing how it confirms that it is not the condition of 'isolation' per se that generates negative effects on economic performance, rather, it seems to depend on place-specific characteristics.

Table 2- *Random Coefficients and Regional Competitiveness.*

VARIABLES	RC for Export	*p-value*
RCI	-0.0166	(0.0149)
D_island	-0.00623	(0.0111)
Constant	-0.208***	(0.00815)
Observations	20	
R-squared	0.072	

*Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. D_Island: dummy variable for main Islands (Sardegna and Sicily).*

---

[4] Le esportazioni delle regioni italiane - I trimestre 2022 (istat.it). Last retrieved on 11/07/2022.

Table 3 – *Export, competitiveness, and Island effect.*

VARIABLES	RC for Export	*p-value*
RCI	-0.0177	(0.0155)
D_Sar	0.00432	(0.00657)
D_Sic	-0.0174*	(0.00900)
Constant	-0.209***	(0.00845)
Observations	20	
R-squared	0.101	

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. D_Sar and D_Sic: dummy variables for Sardegna and Sicily, respectively.

As for the RCI, the results reported in table 3 show that, overall, the regional competitiveness – as measured by the RCI – is not statistically significant to explain the uneven effects of export at the regional level. Nonetheless, a more granular analysis individually considering the 3 pillars of RCI (i.e., 'basic', 'efficiency', and 'innovation', see Dijkstra et al. (2011)) offers nuanced results and further stimulus for additional research. The empirical results are reported in table 4.

Indeed, as shown in table 4, the efficiency pillar is statistically significant and positive both in the case of a single dummy for the island and in the case of 2 separate dummies for the main islands. Hence, the efficiency dimension of competitiveness confirms its crucial role in allowing the regional economies to exploit the potential benefits of export. Quite interestingly, the pillar related to innovation shows a statistically significant negative sign. The dummy for Sicily confirms the usual sign and statistical significance. Thus, the main result for the case at hand (i.e. the penalizing effect of Sicilian insularity) proves to be robust to a variety of econometric specifications.

Table 4 – *Export, pillars of competitiveness, and island effect*

VARIABLES	(1) RC for export	*p-value*	(2) RC for export	*p-value*
Basic	0.0756	(0.0443)	0.0835	(0.0494)
Innovation	-0.106***	(0.0265)	-0.104***	(0.0278)
Efficiency	0.0286**	(0.0107)	0.0259*	(0.0121)
D_Sar			-0.00634	(0.00663)
D_Sic			-0.0262*	(0.0135)
D_island	-0.0161			
	(0.0111)			
Constant	-0.201***		-0.198***	
	(0.0118)		(0.0129)	
Observations	20		20	
R-squared	0.344		0.366	

Note: Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1. D_Sar and D_Sic: dummy variables for Sardegna and Sicily, respectively.

In conclusion, the analysis revealed the spatial heterogeneity in the effects of foreign trade between the Italian regions.

The determinants of such a heterogeneous effect seem to be based on innovation and efficiency, and on these it is necessary to act promptly to fill the economic and social gaps. Furthermore, the robust evidence that the "island" effect plays as a limiting factor in the Sicilian case calls for specific policies. Put differently, our empirical analysis offers a twofold result and, in turn, an additional stimulus for research at different spatial levels. First, at the system level, in order to foster the positive effect of external trade both policymakers and practitioners should place a clear focus on measures aiming to improve the level of efficiency. Second, the datum related to the negative effect of insularity in the Sicilian case only, on the one hand, somehow signals the existence of case-specific structural limiting factors and, on the other hand, challenges the public policy discourse to design and implement place-based policies to address the issue by targeting the main drivers for such negative effect.

4. Policy discussion

Compared to remoteness, insularity poses specific challenges to public policies. Generally speaking, public interventions to counter situations of remoteness and geographical marginalization should mainly aim at eliminating the causes of periphericity. However, in the specific case of islands, physical disconnection from the mainland cannot be eliminated. It is, thus, necessary to act coordinately at different decision-making levels (supranational, national and regional) to promote tailor-made financial and fiscal interventions to compensate island areas for their development disadvantages. Whatever the situation to be faced (i.e., remoteness or insularity), the ultimate objective of public policies is the same: to equalize opportunities and rights between citizens of the same region, state or continent.

To ensure that the adopted measures effectively respond to an equalization objective and are not the mere result of arbitrary decisions, discretion and/or political (e.g., vote-seeking) logics, it is necessary that they are undertaken within a legislative framework that recognizes the economic disadvantages resulting from the island status, attributes differential autonomy to the governments of the insular areas and establishes the responsibilities for public policy interventions (Cerina *et al.*, 2015).

To date, however, the legislation and policies implemented at European level have proved inadequate to deal with the real problems that come from the island condition (among others, Haase and Maier, 2021).

From a legal point of view, attention to insularity has grown over time at European level, going hand in hand with the strengthening of the objectives and

policies to promote economic and social cohesion (Spilanis et al., 2011) and finding full legal protection in art. 174 of the Treaty on the Functioning of the European Union (TFEU). The latter recognizes that island regions face permanent geographical handicaps that require particular attention. However, the principles laid down in Article 174 TFEU have not yet been translated into island-specific budgetary provisions. Indeed, in Cohesion Policy provisions, islands are usually considered within the broader category of "less developed regions", rather than being entitled to specific financial aids. Accordingly, in the 2021-2027 programming period, islands are not expected to receive any dedicated funding, but only have the possibility to modulate the co-financing rates pursuant to Article 121 of Regulation (EU) No 1303/2013.

This inconsistent approach to insularity results in islands in different Member States receiving from "*Cohesion Policy"* amounts that vary considerably, depending on their classification, their situation, and the existence of specific inter-state agreements, responding to general macro-economic considerations rather than territorial specificities.

Islands comprising into the "outermost" regions (ORs) category are an exception to what has been said so far (Perrot, 2021). These belong to France (Saint-Martin, Martinique, Mayotte, Guadeloupe and Réunion), Spain (Canary Islands) and Portugal (Madeira and Azores) but are located in parts of the globe far from Europe, such as the Atlantic or Indian Ocean. For this reason, they are considered to suffer from a double insularity condition, due to their geographical remoteness from 1) the continental lands and from 2) the European Union. ORs benefit from a special status within the EU legislation, being recognized distinctly by Article 349 TFEU, which allows the adoption of specific measures regarding "customs and trade policies, fiscal policy, free zones, agriculture and fisheries policies, conditions for supply of raw materials and essential consumer goods, State aids and conditions of access to structural funds and to horizontal Union programmes".

An important limit to the provision of fiscal compensation and facilitation measures for island regions must be identified in the European legislation on state aid (Article 107(1) TFUE) and in the EU competition policy. The debating issue here is how to reconcile the general prohibition of State aid with the notion of "regional selectivity" (Kurcz, 2007: Moreno González, 2017), and ultimately concerns the relationships between different levels of government. The Court of Justice of the European Community (CJEC) has better clarified the terms of the matter in three different judgments, concerning the reduction of personal and business tax rates applied to the Autonomous Region of the Azores in Portugal (C-88/03) and the legislative autonomy in tax matters of the Basque Autonomous Community in Spain (the joined cases C-428/06 to C-434/06).

Accordingly, to be able to establish tax advantage measures, a region/island must comply with three fundamental requirements: 1) institutional autonomy with respect to the central government; 2) decision-making autonomy; 3) financial autonomy. Based on these principles, the region would become, from a fiscal point of view, a "State within the State": the fiscal measures adopted at national level (e.g., the average tax rate) would no longer be the reference parameter against which to assess the effects of fiscal decisions. Instead, the regional territory and not the national territory would become the reference framework for the assessment of the regionally-implemented advantage measures. However, political and decision-making autonomy alone is not enough but must be accompanied by financial responsibility to prevent the region/island from taking favorable tax decisions, offloading the negative consequences on the central government (a free riding problem).

The aforementioned Community law opens up the possibility for some islands, including Sicily and Sardinia, to adopt "autonomous" subsidy measures, as long as they fully assume the financial consequences, guaranteeing a balanced budget. However, it does not solve the more general problem of public policies to be implemented to compensate for the economic disadvantage suffered by the islands by virtue of their specific status. Recently (June 7, 2022), a further step towards the recognition of the insular dimension in European Union policies and legislation has been made with the approval by the European Parliament of the so-called "Omarjee" resolution on EU islands and cohesion policy (2021/2079(INI))[5]. Among others, with the resolution the European Parliament deplores the lack of EU vision for the European islands and calls for action to be taken to address inequalities between islands and the outermost regions, by reassessing the state aid rules and by adopting a more flexible approach. In addition, it invites the Commission to declare 2024 the European Year of Islands, to request additional financial support and to propose the establishment of a task force on islands.

5. Conclusion

Building upon the theoretical framework of the export-based model this paper explored the presence of an "insularity" effect w.r.t. the contribution of export on GDP at the Italian regional level. A two-step analysis was performed. An RCM was used in the first step and, then, the spatial differences in the estimated RCs were explored in the second step. This procedure fails to detect a generalized island effect

---

[5] https://oeil.secure.europarl.europa.eu/oeil/popups/ficheprocedure.do?lang=en&reference=2021/2079 (INI).

for the Italian case. However, a negative and statistically significant effect is found for Sicily. This confirms that such an effect is place-specific. In other words, from the decomposition of the competitiveness index, further elements of analysis emerge both in the generic vision and in the island condition. In the latter case, innovation and efficiency are also negatively influencing Sicily's exports

Hence, the policy implications of our empirical results are twofold. First, a clear focus on measures aiming to improve the level of efficiency is needed. Second, the negative effect of insularity limited to the Sicilian case only seems to confirm the existence of case-specific structural limiting factors and, therefore, raises the case for place-based policies targeting the main drivers for such negative effects. Undoubtedly, these results at the same time as providing interesting insights, call for further research on its main drivers and, more generally, on the extent and sectors to which it eventually applies.

References

BIAGI, B, DETTORI, B, PACI, R, USAI, S (2019), Economic development in Sardinia: overcoming the insularity gap, in contributi di ricerca CRENoS.

CERINA F., COCCO L., MANNARO K., MARCHESI M., PIGLIARU F., (2015), *Is insularity a locational disadvantage? Insights from the new economic geography*, Centro ricerche economiche Nord Sud (CRENOS)

COCCO L., DEIDDA M., MARCHESI M., PIGLIARU F. (2018) Insularity and economies of density: analyzing the efficiency of a logistic network using an econometric simulation-based approach in *Regional Studies*

DEIDDA M. (2014), *Insularity and economic development: a survey*, Dipartimento di Scienze Economiche e Aziendali, Università` degli Studi di Cagliari, Cagliari, Italy.

DIJKSTRA, L., ANNONI, P. AND KOZOVSKA, K. (2011) A New Regional Competitiveness Index: Theory, Methods and Findings. European Union Regional Policy Working Papers No. 2.

EUROPEAN COMMISSION (2019) Estimating road transport costs between EU regions in JRC Working Papers on Territorial Modelling and Analysis No 04/2019.

FELLMAN K. (2020) Insularity has its advantages in *nordregio.org*

HAASE, D.; MAIER, A. (2021) Research for REGI Committee-Islands of the European Union: State of Play and Future Challenges; European Parliament, Policy Department for Structural and Cohesion Policies: Brussels, Belgium, pp. 1–48.

KURCZ B. (2007), How selective is selectivity? A few thoughts on regional selectivity, *Cambridge Law Journal*, 66(2), 313-324.

MORENO GONZÁLEZ, S. (2017). Taxation and Limits to State Aid: the Case Law of the CJEU on Regional Selectivity and Its Application by Spanish Courts. *European State Aid Law Quarterly*, 16(3), 340–353

NORTH, D. C. (1955) "Location theory and regional economic growth" in *Journal of political economy*,63(3), 243-258.

PERROT, D. (2021), Insularity and Law: Diversity and Changeability of Islands' Statuses—The Example of French Outermost Regions in French and EU Law Systems. *Liverpool Law Review*, 42, 71–85.

SINGH B. and ULLAH A. (1974) Estimation of seemingly unrelated regressions with random coefficients in *Journal of the American Statistical Association* 69 (345), 191–195.

SPILANIS I., KIZOS T., BIGGI M., VAITIS M., KOKKORIS G., LEKAKOU M., PALLIS T., VAJANNI L., KOULOURI M., MARGARIS K., KOUKOUROUVLI N., VANGELAS G., STEFANDAKI E., TOUDAL M., IOANNIDIS D., BALDACCHINO G. AZZOPARDI R.M. (2011) The ESPON 2013 programme: The Development of the Islands, European Islands and Cohesion Policy (EUROISLANDS). Final report. Luxemburg: ESPON & University of the Aegean.

TIEBOUT, C. M. (1956), "Exports and regional economic growth" in *Journal of political economy*, 64(2), 160-164.

SUMMARY

The paper investigates the effects of insularity on economic performance using a Random Coefficient Model (RCM) and the Italian regions as a case study. More in detail, the paper aims to analyse whether a specific 'island effect' can be detected in terms of the economic impact of export on GDP. To this end, building upon the theoretical framework of the export-based model of regional growth, the insularity is considered according to both transportation costs and proper spatial regression models. The very preliminary empirical results fail to detect such an insularity effect and show evidence that the main drivers of the multiplicative effects of export lay in regional efficiency indicators.

_____

Marina CAVALIERI, Università di Catania, mcavali@unict.it
Daniela DI PASQUALE, Università di Catania, danieladipasquale@gmail.com
Benedetto TORRISI, Università di Catania, btorrisi@unict.it
Gianpiero TORRISI, Università di Catania, gianpiero.torrisi@unict.it

PROCESSES OF MARGINALIZATION: DYNAMICS IN LOMBARDY[1]

Simona Ballabio, Flavio Verrecchia, Alberto Vitalini

1. Introduction and theoretical framework

The study of the dynamics of territories and urban areas is fundamental to the analysis of the evolution of demo-social phenomena not only in terms of welfare but also in terms of environmental sustainability and economic growth.

The marginality of territories can be declined in various ways. There is no single formula for determining marginality situations of a socio-economic nature. There are numerous studies that have addressed the issue, including from a plurality of viewpoints. But the method followed, especially in terms of the selection of variables, varies according to the conception of development taken as the basis of the analysis. For instance, for economists, development is predominantly understood as economic growth. For environmentalists, on the other hand, it is respect for the ecosystem. Here we adopt a socio-economic perspective. In other words, we assume that the development gap is primarily determined and fueled by social and economic conditions, which in turn are directly related to the demographic dimension, in a process of action and feedback (Crescimanno, 2009).

At the sub-national level, already since the 1950s, many territories have experienced, and still experience, a process of population contraction, which in small areas can be defined as depopulation (demographic marginality). Indeed, in these areas, a negative balance between births and deaths has been and is also accompanied by a negative migration balance (Reynaud and Miccoli, 2018a).

Depopulation mainly affects mountain and rural municipalities (Rizzo, 2015; Istat, 2018; De Rubertis, 2019). At first, it involves northern municipalities more, then it spreads and affects the rest of the country. Migration to industrialized and urban areas has thus determined or accentuated depopulation processes in many localities (Del Panta and Detti, 2019).

---

[1] Although the work is the joint responsibility of the authors, paragraph 1 and 4 is attributed to S. Ballabio, paragraph 2 is attributed to F. Verrecchia and paragraph 3 is attributed to A. Vitalini.

The rural exodus has never ceased completely, although it has sometimes lost intensity. After the counter-urbanization at the end of the last century, in the 2001-11 decade Italy's largest cities were characterized by a stabilization in the number of residents, followed by a process of urban polarization in recent years. This process has led, in years of demographic stagnation or decline, to a further depopulation of rural areas and smaller towns. Indeed, between 2011 and 2018, small and very small municipalities experienced a drastic decrease in the number of residents. Thus, it is rural areas-characterized by small and diffuse towns, low population density and relative remoteness from larger urban centers-that have suffered the most severe demographic hemorrhages in the long run (Reynaud and Miccoli, 2021).

Negative demographic dynamics are certainly also among the main causes of the socio-economic marginalization of municipalities. The process of depopulation, in fact, underlies a series of recessionary effects described in the literature through the concept of the "spiral of marginality" (Buran, 1998).

A process that is particularly evident in small towns, where limited decreases in absolute terms produce much greater effects than in larger municipalities. Among the consequences attributable to population contraction are: the flight of the high-income population, the weakening of the productive structure (economic marginalization), the cutting back of local services, the degradation of the physical and natural environment, etc. These effects in turn produce further depopulation pressure, generating a perverse spiral and a structural obstacle to territorial revitalization efforts (Martínez-Filgueira *et al.*, 2016). However, there are also other processes that lead to the impoverishment of development opportunities in the territory: scarcity of endowments affects negatively on the attraction of activities and businesses; scarcity of resources and activities affects on the service system and development opportunities; aging of the population, like depopulation, affects on local social networks (Crescimanno, 2009).

From a demographic point of view, depopulation and aging processes are closely linked (Hospers and Reverda, 2015), especially in some areas (Miccoli and Reynaud, 2016). On the one hand, intense out-migration has effects on the age structure of the population, reducing the youth component; on the other hand, young people tend to leave very old settings more, where economic and social opportunities are lower (Reynaud and Miccoli, 2016; 2018b).

From a more historical perspective, in the past the out-migration of the working-age population, and thus depopulation, contributed to the intensification of the ongoing aging process, while in more recent times the latter has itself become the key factor in the depopulation process. Moreover, with all evidence, the aging and depopulation phenomena are both linked to a very low fertility rate (Golini and Mussino, 1987, Golini *et al.*, 2001; 2007; Golini and Lo Prete, 2019).

1.1 Background

This work aims to identify and study shrinking areas that have undergone processes of demographic or economic marginalization by analyzing the dynamics of the last decade, in the Lombard Region at the level of municipal detail. Both indicators from official statistics and spatial databases will be considered in the analyses. In particular, we will use demographic data released by the National Institute of Statistics in addition to income data provided by the Internal Revenue Service (Agenzia delle Entrate). In Lombardy, demographic marginalization affects two separate regional belts: the mountain belt to the north and the lower Po Valley, Oltrepo' Pavese, and Lomellina to the south (Figure 1).

Instead, economic marginalization also, and especially, affects the western part of the region in the municipalities of the local labor systems of Varese, Milan, and Monza (Figure 2). Between the two observed dynamics, there is a slight negative Pearson correlation coefficient -0.31 (Figure 3) that suggests a substantial incorrelation between the two phenomena.

Figure 1 – *Population dynamics, years 2009-2019 (% change I and II quartiles).*
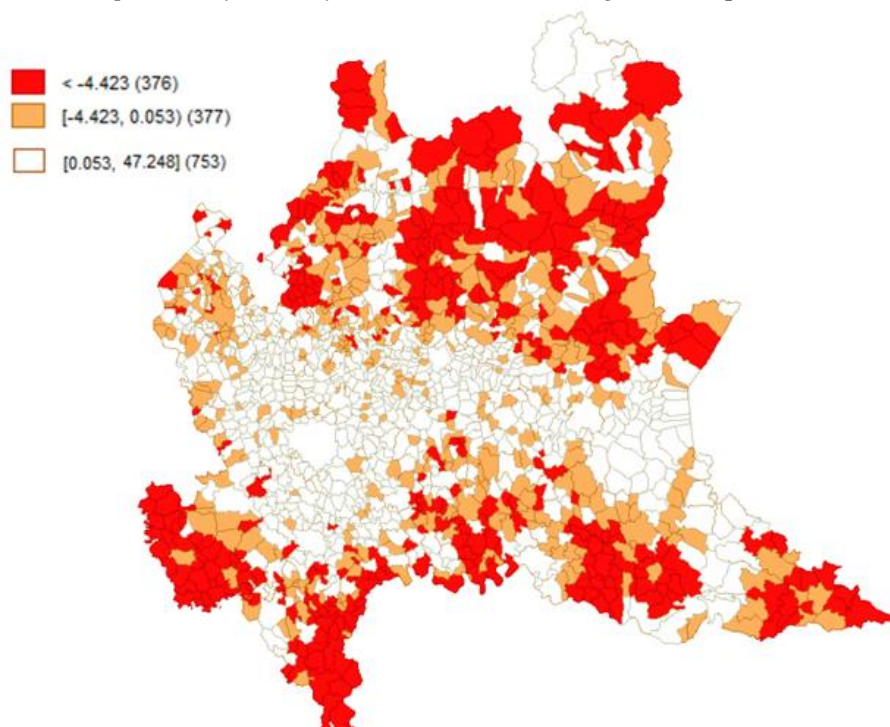
Notes. % change over the whole period 2019/09 in resident population at the municipal level.

Figure 2 – *Dynamics of income per capita, years 2009-2019 (% change I and II quartiles).*
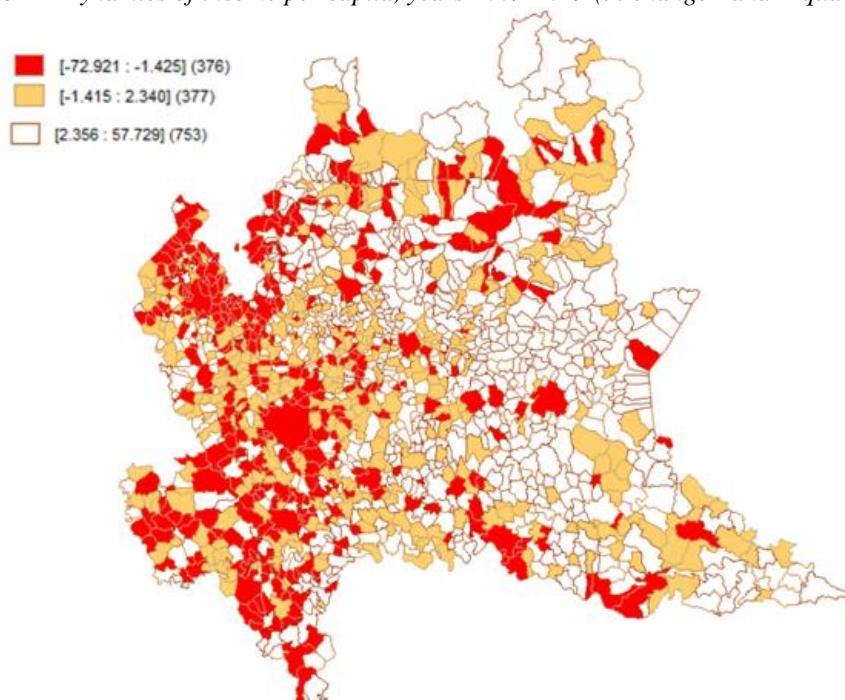
Notes. Percentage change over the whole period 2019/2009 in gross income per capita (2009 income revalued) at the municipal level.

Figure 3 – *Population and income per capita dynamics, years 2009-2019 - Scatterplot of percentage change.*
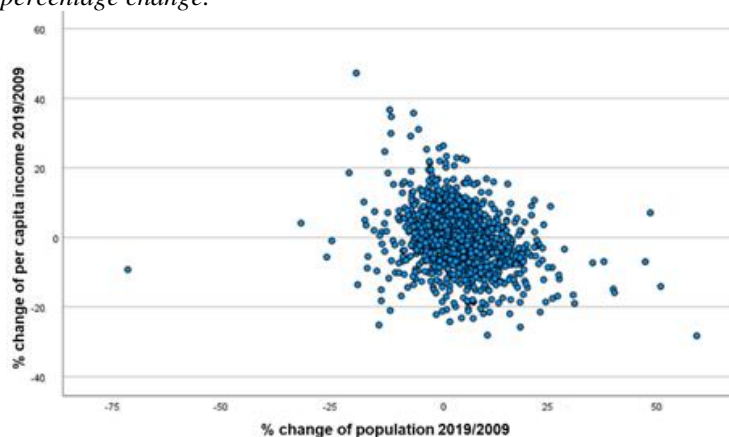
Notes. Percentage change over the whole period 2019/2009, at the municipal level, in resident population and in gross income per capita (2009 income revalued).

2. Definition of a typology

The construction of a spatial typology will be used to identify areas affected by accentuated marginalization dynamics 2009-2019, whose profiles are of interest to the study. Two dummy variables were built:

- Demographic marginalization: value "1" if the percentage reduction of population is less than 4.4 percent (I quartile) and "0" otherwise;
- Economic marginalization: value "1" if the percentage reduction in gross income per capita is less than 1.4 percent (I quartile) and "0" otherwise.

Crossing the two variables, we can identify four types (Figure 4):

- Municipalities not affected by both dynamics of marginalization;
- Municipalities affected only by demographic marginalization;
- Municipalities affected only by economic marginalization;
- Municipalities affected by both types of marginalization.

Figure 4 – *Choropleth map of marginalization typology (four types).*

    ☐   (820) *White - Municipalities not affected by accentuated dynamics of marginalization*

    🟦   (310) *Blue - Municipalities affected only by economic marginalization*

    🟧   (309) *Orange - Municipalities affected only by demographic marginalization*

    🟥   (67) *Red - Municipalities affected by double marginalization*
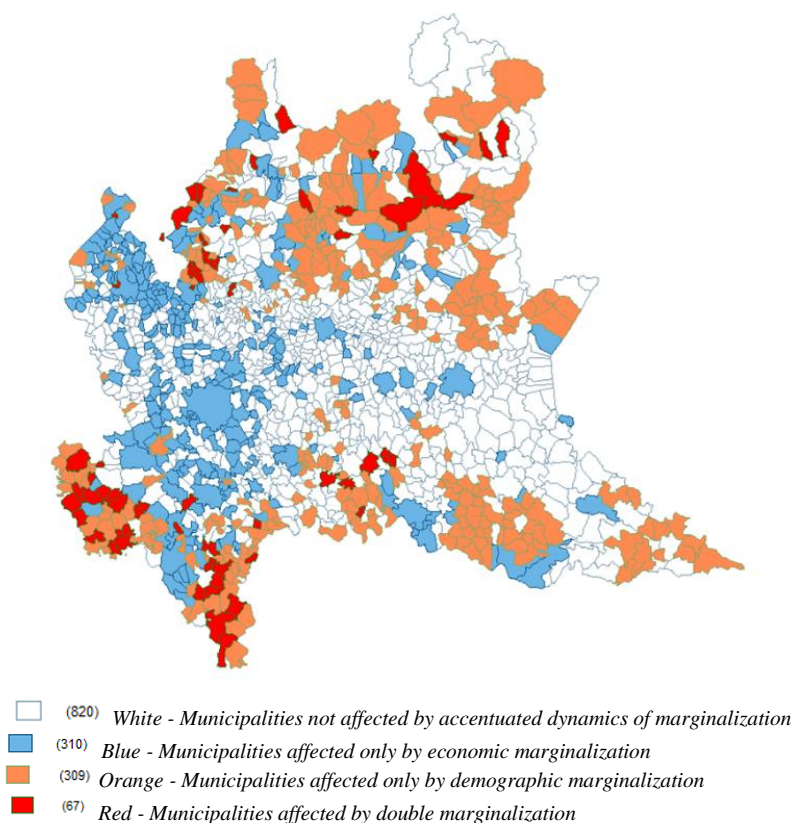
Accentuated dynamics of both economic and demographic marginalization concern, on the one hand, Lomellina, Oltrepo' Pavese, Lodigiano and Cremonese, and on the other hand, in the North, some small hill and mountain municipalities generally under 1,000 inhabitants. As anticipated accentuated dynamics of economic marginalization only concern the west of the region. While accentuated dynamics of only demographic marginalization concern the southern and northern regional belts.

As can be guessed from the indices on income at the local level, the municipalities that seem to be affected by processes of marginalization only economically are among those in which there is greater wealth per capita produced in 2019. In fact, if one looks at both the average income per capita and the 75th percentile of the income per capita of the municipalities grouped in the different types, the areas affected by processes of economic marginalization only - together with the municipalities not affected by pronounced marginalization dynamics - have higher values for these income indicators than the regional figure (Figure 5).

That is, these are municipalities in which diseconomies of urbanization or renewal of labor force with non-EU manpower employed in personal services, which, as is well known, provide low added value.

Figure 5 – *Income per capita, 2019 (Index, Lombardy = 100).*
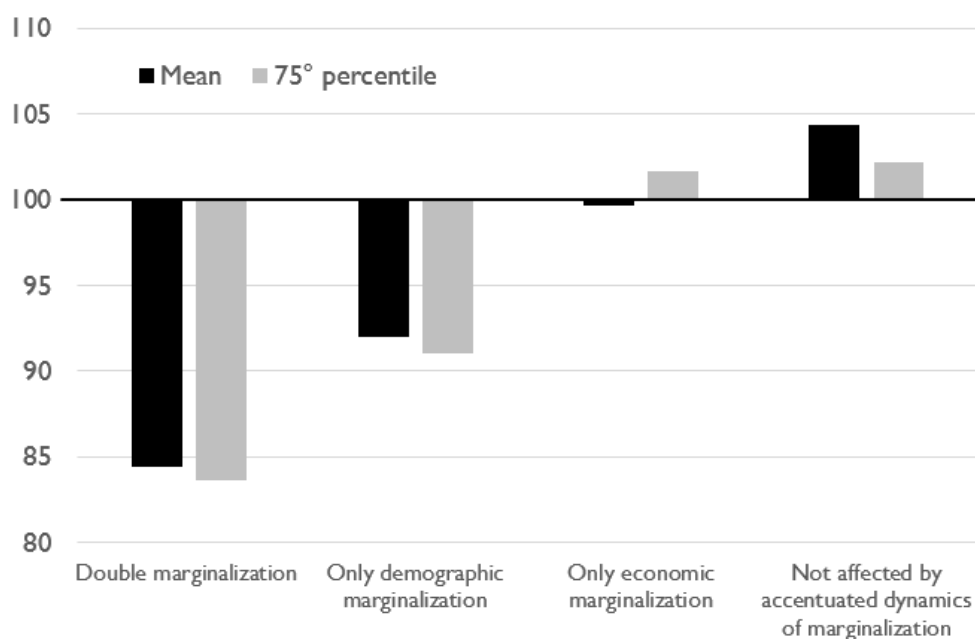
Notes. Mean of municipal income per capita; 75th percentile of municipal income per capita.

3. The characteristic of demographic marginalization

We focus on the 309 municipalities affected only by demographic marginalization: that is in first quartile percentage change of population and not in first quartile percentage change of income per capita (Figure 6).

To deeply study the characteristic of demographic marginalization, we will use a decision tree (or classification tree) strategy to segment the data set. The main purpose of creating a decision tree is to model a series of various events to find out how it affects the possible outcome.

It classifies cases into homogeneous groups, based on values of independent (predictor) variables that predict the values of a dependent (target) variable.

Figure 6 – *A focus on municipalities affected only by demographic marginalization.*

(309)

■ (309) *Orange - Municipalities affected only by demographic marginalization*
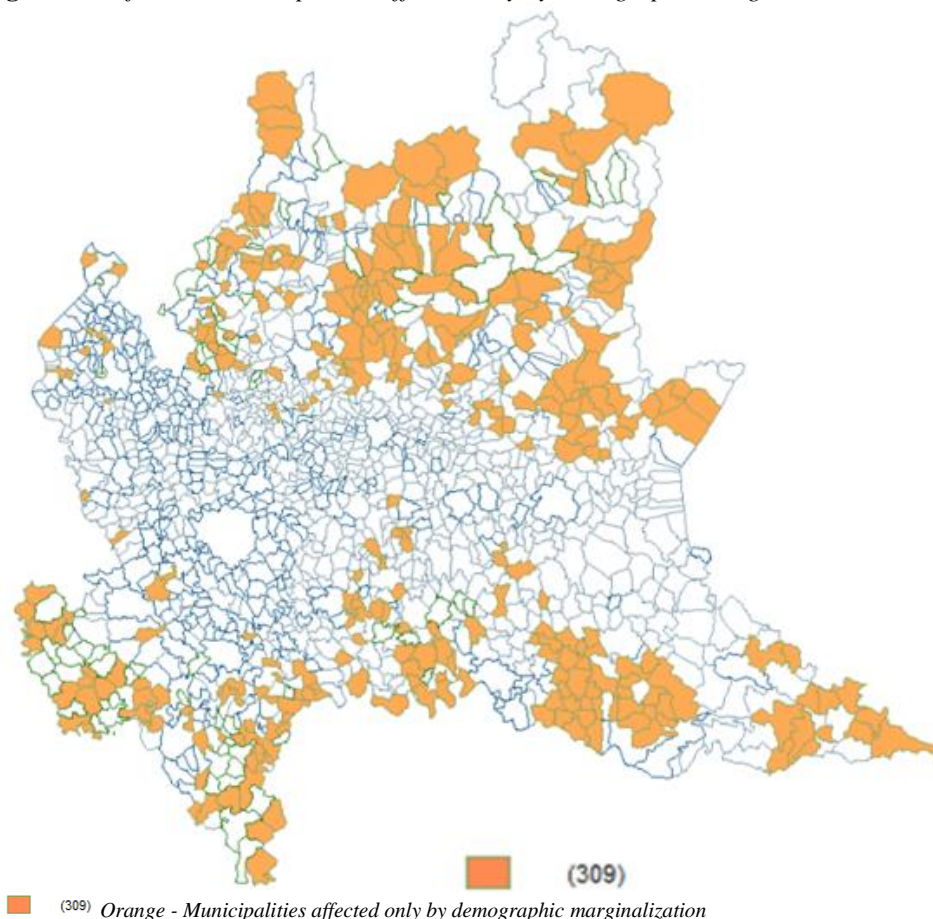
In particular, we will use as statistical tool SPSS Answer Tree and the growing methods CHAID (Chi-squared Automatic Interaction Detection). At each step, CHAID chooses the independent (predictor) variable that has the strongest interaction with the dependent variable. For each node, the tree shows the number and percentage who belong to the target group. The splits of municipalities occur in order of importance. Categories of each predictor are merged if they are not significantly different with respect to the target variable. The target variable is a dummy with "1" if the municipalities are affected only by demographic marginalization and "0" otherwise. The independent variables are: Municipal population size; Altitude zone; Old age index; Total dependency index; Incidence of foreigners; Prevalent tourist category; Local labor system; Agricultural zone; Mountain community; Gross income per capita 2009. Controlling for population size class, the most significant factor is the old-age index, followed by income per capita in 2009 (Figure 7).

Figure 7 – *Classification tree.*
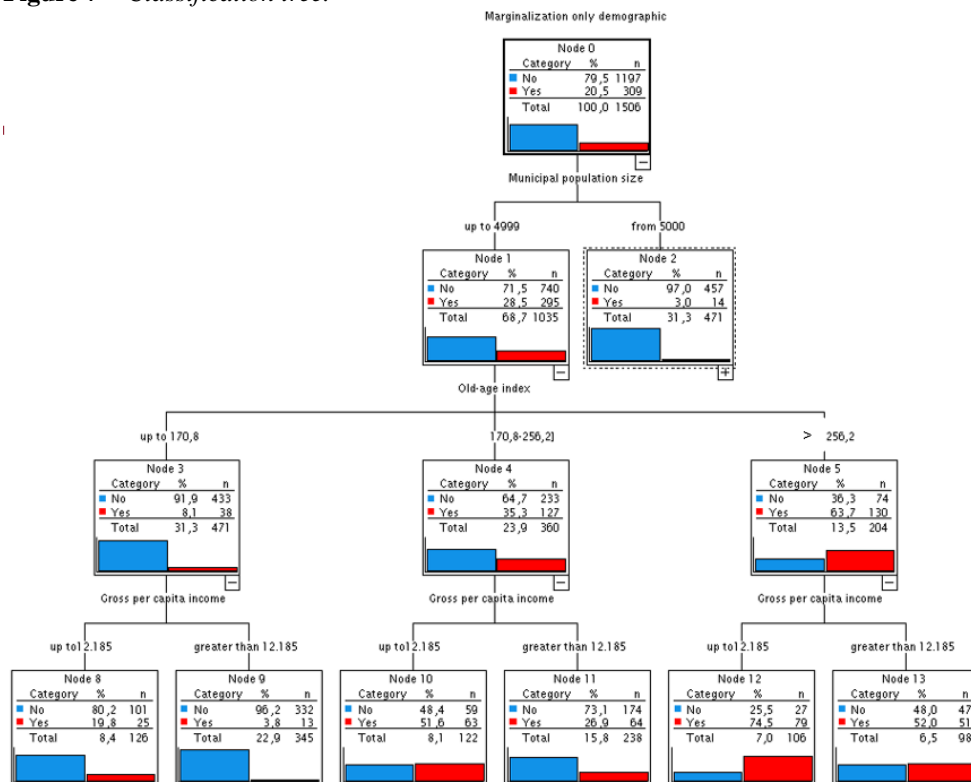
First: demographic marginalization processes mainly affect small municipalities: the percentage of municipalities, affected only by demographic marginality, rises from 3.0% among municipalities with more than 5,000 inhabitants to 28.5 percent among those with less than 5,000 inhabitants.

Second: as emerged from the literature, demographic marginality in Lombardy is also positively correlated with population aging. Considering the population size below 5,000 inhabitants, the percentage of municipalities, characterized by demographic marginality, rises from 8.1% in the group with an old-age index below 170.8 to 63.7% among those with an index above 256.2.

Third: considering the population size of less than 5,000 and controlling for the old-age index, gross income per capita in 2009 is correlated with the process of demographic marginality. Among municipalities with a population of less than 5,000, the percentage is significantly higher in the group of municipalities with gross income per capita up to 12,185 euros than in those with gross income per capita above 12,185 euros. Specifically, 19.8 percent versus 3.8 percent among municipalities with an old-age index up to 170.8; 51.6 percent versus 26.9 percent among municipalities with an old-age index between 170.8 and 256.2; and 74.5 percent versus 52.0 percent among municipalities with an old-age index above 256.2.

This finding suggests that municipalities, which, between 2009 and 2019, seem to be affected only by demographic marginality may also be characterized by economic fragility that is the product of socio-economic dynamics, which occurred in an earlier period, including the exit of the high-income resident population and the weakening of the production system.

4. Final remarks

The importance of a spatial analysis of socio-demographic dynamics to support local development policies is highlighted. Considering, in Lombardy, the processes of demographic and economic marginalization, during the last decade, at the level of municipal detail, some clear patterns of spatial-level organization emerge. Demographic marginalization affects two separate regional belts: the mountain belt to the north and the lower Po Valley, Oltrepo' Pavese, and Lomellina to the south. Economic marginalization affects the western part of the region in the municipalities of the local labor systems of Varese, Milan, and Monza.

Considering the two processes simultaneously, some final thoughts can be made.

First, some municipalities are affected by dual dynamics of marginalization that have been accentuated over the past 10 years.

Second, municipalities that, between 2009 and 2019, appear to be affected only by processes of economic marginalization are municipalities where diseconomies of

urbanization or attraction of non-EU labor employed in personal services may have occurred.

Third, municipalities that, between 2009 and 2019, appear to be affected only by processes of demographic marginalization could be characterized by significant economic fragility produced by the outflow of the high-income resident population and the weakening of the production system, occurred in an earlier period.

Fourth, demographic characteristics such as urban size and old-age index are important factors in the spatial variability of demographic and economic marginalization processes on a local scale.

Acknowledgements

References

BURAN P. (ed) 1998. Le misure della marginalità. I fattori del disagio territoriale delle aree montane piemontesi. *Working Paper* 121, Ires Piemonte, Torino.

CRESCIMANNO A., FERLAINO F., ROTA F.S. 2009. *Classificazione della marginalità dei piccoli comuni del Piemonte*, IRES. Istituto di Ricerche Economico Sociali del Piemonte.

DEL PANTA L., DETTI T. 2019. *Lo spopolamento nella storia d'Italia*, 1871-2011. Libri, atti e raccolte di saggi, 15-28.

DE RUBERTIS S. 2019. Dinamiche insediative in Italia: spopolamento dei comuni rurali. In CEJUDO E. & NAVARRO F. (eds), *Despoblación y transformaciones sociodemográficas de los territorios rurales: los casos de España, Italia y Francia*, Perspectives on rural development, 3. 71-96

GOLINI A., BASSO S., BUSETTA A. 2007. *Malessere demografico e socio-economico. Un'analisi sui comuni italiani al 2001*. NIKE, 2-3, 237-294.

GOLINI A., LO PRETE M.V. 2019. *Italiani poca gente. Il Paese ai tempi del malessere demografico.* Luiss University.

GOLINI A., MUSSINO A. 1987. *Individuazione e caratteristiche demografiche delle aree di malessere*. Società Italiana di Statistica. Convegno, 393-417

GOLINI A., MUSSINO A., SAVIOLI M. 2001. *Il malessere demografico in Italia: Una Ricerca sui Comuni Italiani*, Il Mulino, Bologna

HOSPERS G.J., REVERDA N. 2015. Demografic change, In HOSPERS G.J., REVERDA N. *Managing Population Decline in Europe's Urban and Rural Areas*, Springer: Cham, Switzerland.

ISTAT 2018. *L'evoluzione demografica in Italia dall'Unità a oggi*, web: www.istat.atavist.com.

MARTÍNEZ-FILGUEIRA X., PEÓN D., LÓPEZ-IGLESIAS E. 2016. *Intra-rural divides and regional planning: An analysis of a traditional emigration region (Galicia, Spain)*, Eur. Plan. Stud., 25, 1237-1255.

MICCOLI S., REYNAUD C. 2016. *Invecchiamento demografico: dinamiche nelle province italiane*, Eyesreg, 6(2).

REYNAUD C., MICCOLI S. 2016. Spopolamento e invecchiamento: una difficile relazione nelle aree di malessere demografico. In FORNASIN A., LORENZINI C. (eds), *Per una storia della popolazione italiana nel Novecento*, Udine: Forum, 2016, 247-258.

REYNAUD C., MICCOLI S. 2018a. *Lo spopolamento nei comuni italiani: un fenomeno ancora rilevante*, Eyesreg, 8(3).

REYNAUD C., MICCOLI S. 2018b. *Depopulation and the aging population: The relationship in Italian municipalities*, Sustainability, 10(4)

REYNAUD C., MICCOLI S. 2021. *Lo spopolamento in Italia di ieri e di oggi*, Giornale di storia, 35.

RIZZO A. 2015. *Declining, transition and slow rural territories in southern Italy Characterizing the intra-rural divides. European Planning Studies*, Eyesreg, 8(3).

SUMMARY

The observation of the dynamics of territories and urban areas is fundamental to the analysis of the evolution of demo-social phenomena not only in terms of welfare but also of environmental sustainability and economic growth.

The aim of the work is to identify and study shrinking areas that have undergone processes of demographic and economic marginalization in the last decade, in the Lombardy context and at a municipal level of detail.

Both indicators from official statistics and spatial databases will be considered in the analyses. In particular, use will be made of demographic data released by the National Institute of Statistics in addition to income data provided by the Internal Revenue Service.

The construction of a spatial typology will be used to identify areas affected by marginalization processes whose profile it is of interest to study, thanks to methods based on decision trees.

Related to the results, this paper notes that spatial characteristics -such as, for example, geographic area, urban size, etc. - are important factors in the spatial variability of demographic and economic marginalization processes at the local scale. These results highlight the importance of a spatial analysis of socio-demographic dynamics to support local development policies.

_____

Simona BALLABIO, Istat Northwest Territorial Office, ballabio@istat.it
Flavio VERRECCHIA, Istat Northwest Territorial Office, verrecchia@istat.it
Alberto VITALINI, Istat Northwest Territorial Office, vitalini@istat.it

THE DESTINATIONS OF RESEARCH ACTIVITY IN ISTAT: STATISTICAL METHODS OF BUSINESS INTELLIGENCE FOR ENHANCING TERRITORIAL INFORMATION[1]

Alessandra Dentini, Matteo Mazziotta, Iole Zeppieri

1. Introduction

The paper is inspired by the assumption "Scientific research is culture and culture is wealth". Moreover, the term wealth must be understood not exclusively from an economic point of view but in a much broader sense where knowledge of the territory, for example, has a strategic importance for the definition of local policies in order to improve the citizens' quality of life. The National Institute of Statistics (Istat) is currently the second research institution in Italy for the number of researchers, since its inception and subsequently since the establishment of the National Statistical System (SISTAN) plays a key role in providing impartial tools for understanding and decide. More than one thousand researchers contribute to the production of economic, social, territorial, demographic, accounting, stock and flow statistics; they participate in conferences, meet national and international organizations, attend universities, other research institutes, they discuss with both national and local institutions, governmental and non-governmental, scientific societies and components of the so-called "country system". Istat researchers are engaged on territory for meetings, seminars, training, collaboration with local government, cooperation projects and so on. Therefore, Istat researchers move and carry out duty travel. Recently, the great information capacity by the Istat duty travel database has been understood, which constitutes a highly articulated source of information, with dozens of variables, more than ten years available and the possibility of nowcasting. To sum up,Istat duty travel database is a "Research map". The aim of the paper is to analyse the database with a view for profiling the Italian municipalities where Istat has already carried out duty travel and identified together with local institutions, new possible destinations that can host research and promotion events for territorial data. Istat internal experimental initiative aims to enhance the area with events dedicated to socio-economic research using statistical data from administrative sources. This is an exploratory analysis of the Istat duty

---

[1] The paper is the result of the common work of the authors: in particular A. Dentini has written Sections 3 and 4, M. Mazziotta has written Section 1, I. Zeppieri has written Sections 2 and 5.

travel database with two research questions: the first one aims to analyse the characteristics of the municipalities (small and very small) where Istat has already carried out duty travel so that municipalities are profiled through a composite index that measures the socio-economic conditions of the territory. The second research question seeks to identify Italian municipalities similar in profile to the previous ones where however duty travel have never been carried out. The paper is organized as follows. Section 2 provides some background on data sources and the construction of the database; In Section 3, the methods for analysing data, from a business intelligence point of view, are presented. The results of statistical elaborations and the comments are proposed in the Section 4. Some final remarks follow in the concluding Section 5.

2. Data source and database construction

The Human Resources sector of Istat has been using URBI Smart as a management operating system since 2016. The application system manages various areas of human resources, including the legal and accounting management of employee duty travel and external staff who carry out activities for the Institute.

In order to build a database that is statistically informative for the study of duty travel in Istat, it is necessary to review the work process divided into phases, starting from the rationalization of the information present in URBI in order to select the variables to be analysed for statistical purposes. The goal is to transform an administrative database, made up of multiple management variables, mainly used as a repository of administrative data, into a statistical database, capable of making the data classifiable and usable for statistical purposes.

The duty travel information selected from URBI are made up of a several variables which include employee identification data (registration number, profile, staffing plan), duty travel administrative data (number of assignments, duration, destination, object and institution visited, cost centre) and finally, the detail of the cost items for single duty travel expenditure (type of transport, board and lodging).

The data analysis covered the period 2009-2019 (eleven years) since this last year essentially represented the end of the duty travel due to the health emergency.

The first phase towards the construction of the database involved the transposition of the raw matrix in order to obtain the single duty travel for each record (row).

Subsequently, the matrix underwent some changes summarized as follows:

- normalization of the cost items of duty travel for the years 2009 and 2015 when the management information system was different (SIGED was before URBI);

- normalization of the "Destination" variable in foreign countries and Italy, with a further subdivision by region, province and municipality;
- normalization of the "Destination" variable since the names of the destinations themselves were registered in a non-univocal way;
- normalization of the "Object of the duty travel" variable into four categories:
  - scientific meeting;
  - training;
  - internal meeting;
  - other institutional activities.
- classification by items of expenditure (travel, food and accommodation).
- In order to merge the original database and the Amisuradicomune[2] repository, it is necessary to add the municipal (and therefore provincial and regional) Istat code for each municipality. Then, the following socio-economic and demographic individual indicators are attached to each geographical destination:
- high school (25-64 years old who have completed at least second-degree secondary school per 100 people aged 25-64);
- bachelor (30-34 years old who have obtained a university degree per 100 people aged 30-34);
- employment rate (20-64 years employed in October for 100 people of 20-64 years)
- gross income per capita (total gross income of households divide by the total number of members households);
- entrepreneurship rate (number of firms per 1,000 inhabitants).

Subsequently, the destinations of duty travel are divided in five geographical areas: 1. Middle, 2. Islands, 3. Northeast, 4. Northwest and 5. South

It is about 23,300 duty travel carried out in 735 municipalities; in addition, the variable "Population size" (divided into five classes: 0-9.99k; 10k-19.99k; 20k-49.99k; 50k-99.99k; over 100k) has enriched the information of each row.

The final structure of the database, representative at the municipal level, reports the following variables: identification code of the municipality, value of the composite index (MPI), dichotomous flag to characterize the municipality already visited, Geographical area, region, province, number of duty travel in the municipality, cost, population size. These variables are used in the statistical

---

[2] "AmisuradiComune" is a multi-source statistical information system that aims to provide an articulated set of indicators at municipality territorial level useful for the planning, programming, and management of Local Governments.

analysis in order to classify the municipalities in which Istat researchers have carried out duty travel in the years considered.

3. Methods of Analysis

In order to profile the Italian municipalities simple and complex statistical analyses are calculated. A set of descriptive statistics have outlined the basic characteristics of the phenomenon. Istat duty travel take place in Italy and abroad with different purposes; they have similar durations, and the destinations can be multiple, especially in correspondence with the censuses. With regard to complex analyses, we wanted to measure the multidimensional phenomenon "Socio-economic context" by selecting a set of elementary indicators at the municipal level from the Amisuradicomune source: Level of education, Employment rate, Gross Income per capita, Entrepreneurship rate, Attractiveness rate. A composite index is calculated with the Mazziotta and Pareto method (MPI). In order to make a complex phenomenon readable, it is necessary to apply statistical methods that can reduce the multidimensionality. Usually, additive methods for constructing composite indexes, such as arithmetic mean, are based on requirements and have properties that are often undesirable or difficult to satisfy. For example, if a complete substitutability between the dimensions of the index is assumed then a deficit in one component can be offset by a surplus in another. Usually, for numerous socio-economic phenomena, complete compensability between the individual indicators is not acceptable and a "balanced" distribution of values is required (Mazziotta and Pareto, 2013).

The method proposed for this contribution intends to provide a synthetic measure of a set of indicators that are considered "non-replaceable", i.e., it is necessary that all the dimensions of the phenomenon are 'balanced' (Mazziotta and Pareto, 2016). The Mazziotta and Pareto Index (MPI) is designed to meet the following properties: (i) normalization of the indicators with a specific criterion that purifies the indicators both from the unit of measurement and from their variability; (ii) synthesis independent of an "ideal unit", given that a set of "optimal values" is arbitrary, not unique and can vary over time; (iii) simplicity of calculation; (iv) ease of interpretation; (v) robustness of the results (Mazziotta *et al.,* 2010).

These properties can be satisfied with the following approach. As it is known, distributions of different indicators, measured differently, can be compared by transforming them into z-scores. Therefore, the individual indicators are converted so that they all vary within the same scale, with average equal to 100 and mean square error equal to 10: the values thus obtained will be included approximately in

the range 70-130. In this type of normalization, the "ideal vector" is the set of average values and it is easy to identify both the units above the reference value (values above 100) and the units below it (values below 100). Furthermore, the normalization with z-score allows to purify the indicators of their variability and to assign them the same weight.

In this context, a penalty coefficient is introduced which depends, for each unit, on the variability of the indicators with respect to the average value ("horizontal variability"): this variability is measured through the coefficient of variation. The proposed approach penalizes the score of each unit (the arithmetic mean of the standardized values) with a quantity that is directly proportional to the "horizontal variability". The goal is "to reward" the units that, with the same average, present a greater balance between the values of the indicators (Mazziotta and Pareto, 2020).

The composite indices at the municipal level are used in a regression tree model in order to characterize the territory according to its attractiveness and develop an effect of enhancing the knowledge of statistics on the territory.

4. Results

The analyses of the database started from the simplest ones (univariate) in order to know some characteristics of the variables. In Figure 1, the map of Italy based on the number of duty travel per province is presented. The map clearly shows that the main cities, from North to South, are the most reached for work / research reasons in the time considered.

Figure 1 – *The map of Italy by number of Istat duty travel.*
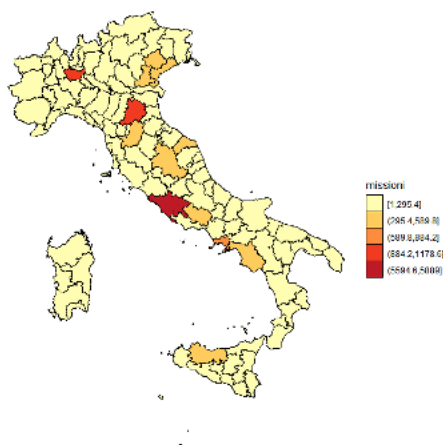
Elaborations from Istat duty travel database.

Complex statistical analyses provide us with a more integrated reading of the data, highlighting interesting causal relationships. The applied models, regression trees, allow to find a link between a response variable (quantitative) and a series of independent variables (quantitative and qualitative). A regression tree is built through a process known as binary recursive partitioning, which is an iterative process that splits the data into partitions or branches, and then continues splitting each partition into smaller groups as the method moves up each branch.

These are classification algorithms that allow, in our case, to group Italian municipalities (where Istat has carried out duty travel) by similar socio-economic condition.

In Figure 2 a regression tree for all 735 municipalities considered in the analysis is presented, where Istat carried out duty travel between 2009 and 2019. The response variable is the number of duty travel and the independent variables are the socio-economic indicators extracted from Amisuradicomune. The aim of this attempt is to understand if the number of duty travel depends, and in what way, on geographic location variables and indicators as level of education, employment rate, gross income per capita, entrepreneurship rate. The result of the classification method is very interesting since the only variable that seems to characterize the analysis is the number of duty travel carried out by Istat researchers is the educational level of the destination municipality.

The first variable that discriminates is the percentage of high school graduates. With perfect direct proportionality, as the percentage of graduates' increases, the average number of duty travel in the municipalities increases. Let's see in detail. In node 1, the level of graduates is less than 50.6% and the average number of duty travel per municipality is approximately 3; in node 2 the percentage of graduates is between 50.6 and approximately 62 and the average number of duty travel per municipality is approximately 14; in node 3 the level of graduates ranges from 64.2% to around 70% and the average number of duty travel per municipality is around 30; in node 4 the percentage of graduates is over 70% and the average number of duty travel is over 185.

In addition, in node 2, a further partition generates three nodes derived from the gross income per capita variable. The same number of duty travel is concentrated in node 6 (from almost 11,000 to 12,247.5 euros) and in node 7 (more than 12,247.5 euros), respectively 2,214 and 2,126; in node 5 (the one with the lowest income) about 735 duty travel is concentrated. Here too there is a direct proportionality: as gross income per capita increases, the number of duty travel per municipality increases. The same node 7 is partitioned into two nodes for the high school diploma variable and, as in the other nodes, as the percentage increases, the average number of duty travel per municipality increases significantly: almost 6 for node 10 and over 21 for node 11. This phenomenon is also very visible in node 3

which is divided into two further nodes per level of university graduates. In node 8, the level of graduates is less than 33.65% and the average number of duty travel per municipality is equal to approximately 16. On the other hand, in the municipalities with a higher percentage of graduates (more than 33.65), the average number of duty travel per municipality is almost equal to 51.

Figure 2 – *Regression Trees of socio-economic conditions of the municipalities where Istat carries out duty travel.*
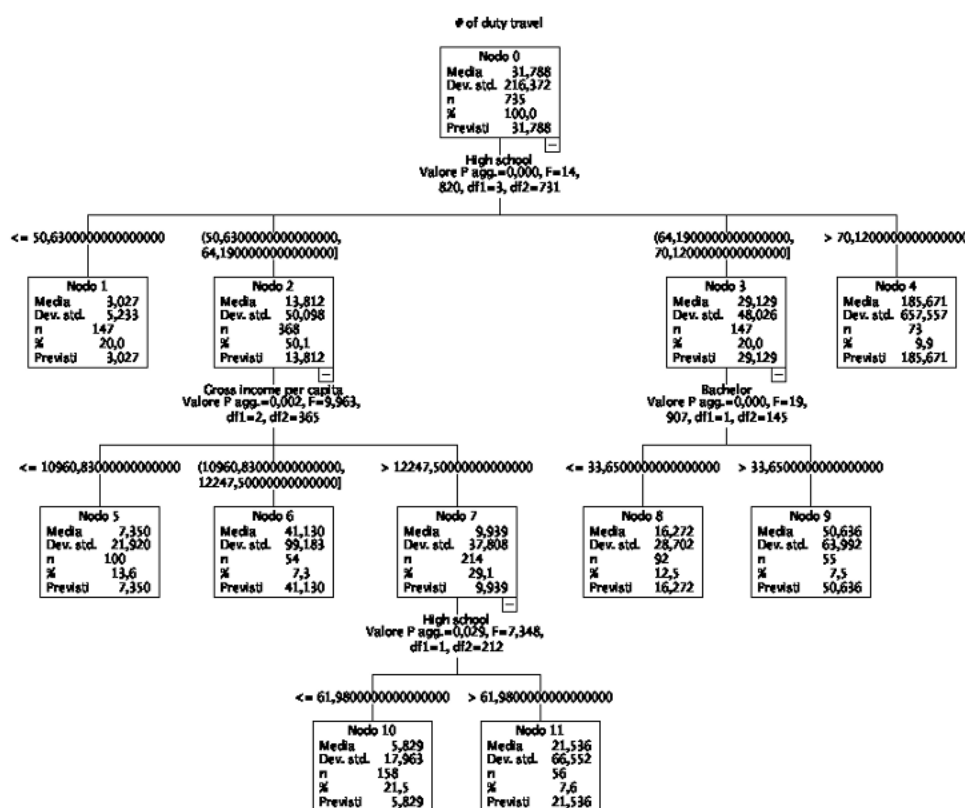
Elaborations from Istat duty travel database.

Therefore, the evidences that emerge from our first analyses (simple and complex) show that the duty travel in Istat take place mainly where the level of education is on average higher than elsewhere therefore, most likely in large towns.

Perhaps this first conclusion may seem not particularly original, but it is very clear in the data and must move us towards other analyses that make clear what is hidden. With this in mind, we need to exclude large cities from the dataset and understand what happens in smaller places. We have reduced our database from 735 destination municipalities to 329: the municipalities between 10,000 and 50,000 inhabitants (population size 2 and 3) are included. A composite index based on the MPI method, described in the previous paragraphs, on the socio-economic conditions of the municipalities is calculated in order to synthesize information and reduce dimensions.

Figure 3 – *Regression Trees of socio-economic conditions of the small municipalities where Istat carries out duty travel.*

Elaborations from Istat duty travel database.
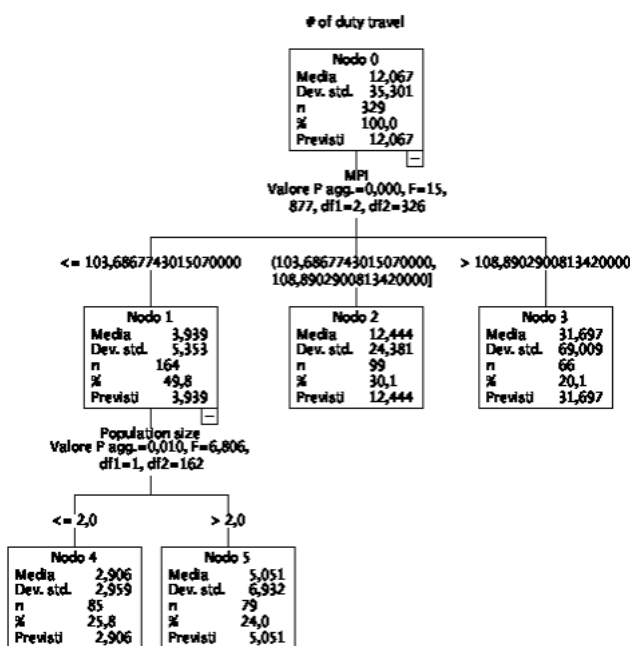
The new regression tree has the number of duty travel as its response variable, and the geographical location of the municipality, the composite index and the population size as independent variables. The results of this new tree seem decidedly interesting, in fact it is noted that in the medium-small municipalities the

first discriminant that influences the number of Istat duty travel is the composite index on socio-economic conditions.

Analysing the regression trees based on MPI results, the first result is very clear. In node 1, there are 164 municipalities in which the composite index has a value less than 104; in node 2, there are 99 municipalities in which the composite index has values between 104 and around 109, while in node 3, there are 66 municipalities in which the MPI has values greater than 108.89. Above all, the same phenomenon of Table 2 has occurred. A direct proportionality between the socio-economic conditions of the municipality and the number of duty travel is very evident. As the MPI per municipality increases, the duty travel increase significantly. It goes from almost 4 duty travel of node 1 (medium-high MPI) to more than 12 for node 2 (high MPI) to almost 32 for node 3 (very high MPI).

In addition, node 2 and node 3 in as many as 165 municipalities where duty travel is carried out with a composite index higher than almost 104 (Italy is equal to 100). This means that the Istat plans its duty travel mainly in municipalities that have high socio-economic conditions.

In node 4, the 85 municipalities included in the population range between 10,000 and 19,999 inhabitants have the average of duty travel equal to 3, while in node 5 there are 79 municipalities included in the population range 20,000 and 49,999 with the average of duty travel equal to 5.

Basically, excluding large cities, Istat plans missions in small and medium-sized municipalities (from about 10,000 to 50,000 inhabitants) with high socio-economic conditions. However, there are a few dozen such municipalities and they are scattered throughout the national territory. Due to the results it is possible to classify the Italian municipalities in which Istat has never done duty travel that have a composite index value higher than about 104. In this way, Istat will be able to study business travel solutions in which to plan events for the enhancement of the data of the territories and municipalities that are ready to host, from the receptive point of view, cultural events for statistical and scientific promotion.

5. Conclusions

The paper is one of the first example of Business Intelligence (BI) in Istat, in which data purely used for administrative matters are used to obtain useful information for the management of research activities, economic savings policies, relations with other institutional organizations and much more. We are talking about a wealth of information to be exploited to increase the effectiveness of some internal and external processes of the National Institute of Statistics.

The first results of the research are encouraging and embracing various topics of study. The analysis presents, on one hand, the evolution of official statistics research on the national territory (scientific and supportive to local governments) and, on the other hand represents a very effective tool able   to identify a classification of the Italian municipalities that can host events and make them a driving force for raising awareness of the statistical culture. This classification at the municipal level, therefore, allows an integrated reading of the structural potential of a territory and the context that promotes development activities.

This research experience must be understood as inserted within the context of profound innovation that statistics (not only official) are going through from the point of view of the use of administrative sources in order to represent complex realities with increasingly clear images that can assist the stakeholders in strategic choices.

The exploitation of the Istat duty travel database is a classic example of the use of administrative data for the development of Business Intelligence. In fact, BI refers to the ability to make better decisions, take informed action, and implement more efficient business processes. BI capabilities allow to: accept updated data from your organization; present data in easy-to-understand formats; provide data in a timely manner in order to make strategic decisions.

This paper has precisely the objective of processing internal data to obtain useful information to be used to improve internal management processes. The analyses carried out are useful for understanding the profile of the municipalities in which Istat carries out duty travel. These are 735 municipalities: why has Istat never gone to work in other 7,000 municipalities? Is it possible to identify municipalities (similar in socio-economic conditions to those already visited) in which it is possible to organize events for the enhancement of official statistics and therefore of the territory itself? The statistical techniques used show that it is possible to have a set of municipalities where it is possible to host events in which the scientific and local communities can discuss the increasingly updated and detailed statistics produced by Istat, and enhance the ability to make strategic decisions for the host territory. Istat is at the service of the areas of the country in order to be able to enrich the information held by local public decision makers in order to understand and decide.

The first results are very encouraging because, thanks to the application of composite indexes and regression trees, it is possible to profile the Italian municipalities where duty travel have already been carried out and identify new ones that have all the desirable characteristics to create new duty travel and events of enhancement of the territorial statistical heritage. The first elaborations have produced a set of municipalities where to organize events: the good news is that these municipalities are uniformly distributed throughout the country so that we

can be present in the many specificities that represent, in history, the great wealth of Italy.

References

MAZZIOTTA C., MAZZIOTTA M., PARETO A., VIDOLI F. 2010. La sintesi di indicatori territoriali di dotazione infrastrutturale: metodi di costruzione e procedure di ponderazione a confronto, *Rivista di Economia e Statistica del Territorio*, Vol. 1, pp. 7-33.
MAZZIOTTA M., PARETO A. 2020. *Gli indici sintetici*. Torino: Giappichelli editore.
MAZZIOTTA M., PARETO A. 2016. On a Generalized non-Compensatory Composite Index for Measuring Socio-economic Phenomena, *Social Indicators Research*, Vol. 127, No.3, pp. 983-1003.
MAZZIOTTA M., PARETO A. 2013. Methods for Constructing Composite Indices: One for All or All for One?, *Rivista Italiana di Economia Demografia e Statistica*, Vol. LXVII, No.2, pp. 67-80.

SUMMARY

The Istat duty travel database is a precious source for understanding, from a geographical point of view, where, over the years, the work of so many researchers has taken place. The use of statistical methodologies for business intelligence made it possible to profile the Italian municipalities (already visited for duty travel) according to socio-economic conditions. These classification methods are used to have a set of Italian municipalities (never visited) that have similar characteristics to the previous ones and, therefore, the ability to host cultural events for the promotion of territorial data.

_____

Alessandra DENTINI, Istat, aldentin@istat.it
Matteo MAZZIOTTA, Istat, mazziott@istat.it
Iole ZEPPIERI, zeppieri@mail.it

VARIANCE ESTIMATION OF CHANGES IN OVERLAPPING SAMPLES: AN APPLICATION TO THE ITALIAN SURVEY ON SERVICE TURNOVER[1]

Diego Chianella

1. Introduction

This work was inspired by the growing need to have a measure of the accuracy of the estimates produced within the short-term statistics in the Official Statistics. In particular, the aim of the work is to illustrate the methodology for the computation of the variance for the estimators currently used in the Italian service turnover survey (ISTS, for brevity) carried on by the Italian National Institute of Statistics (ISTAT) for the quarterly turnover growth rate estimation. While the calculation of the variance of the estimates produced for a given instant of time is now a good practice (also through the development of software packages), the same does not happen for the variation of two quantities over time. An estimator of variance must take into account of both the estimator and the sampling design (Wolter, K.M. (1985)). The greatest difficulty is that for many surveys, the samples for producing estimates in two different time are not independent each other, due to the rotation operations of the sample. In particular for business surveys, in order to take into account the birth-mortality of units in the population and changes in stratification variables (such as size category and type of economic activity), the sample is updated, and a part of the units is replaced with others. This means that in calculating the estimate of the variance of change over time, we need not only the estimates of the variances of the cross-sectional estimates, but also the covariance terms between cross-sectional estimates. Moreover, many indicators are non-linear function of linear estimators (e.g. simple ratio, difference of ratios), therefore, to calculate their variance a first-order Taylor approximation can be used. This is the case, for example, for the variance estimations of the LFS-based indicators' annual net changes (Ceccarelli *et al.,* (2017)). Alternatively, balanced repeated replication (BRR) can be used (Moretti *et al.,* (2005)). The variance for the estimators

---

currently used in the service turnover survey is computed only for the total estimations in the quarters t and t-4, while the variance of the growth rate estimation for the different estimation domains is not calculated. The aim of the present paper is not only to suggest how to assess the variance of possible estimators of the turnover variation over time, but also to compare such estimators with respect to their variance to identify the best one.

2. Description of the survey: sampling design and method of estimation

The ISTS[2] uses a stratified simple random sampling without replacement. The auxiliary information for the planning of the design is contained in the Istat Statistic Register of Active Firms (ASIA). ASIA is a register of enterprises and local units updated annually by Istat through a process of integrating administrative and statistical sources. It includes all economic units in industry and service sectors and provides identifying and structure information of these units. The information in it contains a time lag of two years. Each year, the sample for the ISTS is updated to account for both a re-stratification of the units and a sample replacement of approximately 15%. The units in the sample are re-stratified according to their actual size and economic activity from ASIA. Dead companies are discarded from the sample, together with the companies that have been in the sample for several years. New companies are randomly selected from the last ASIA available, excluding the units already in the sample (plan A of Tam, 1984), until the theoretical size provided by the Mauss-R software (see Barcaroli *et al.,* 2010), is reached within each stratum. New companies entering in the sample are required to indicate the turnover data for both the current year (t) and the previous year (t-4). In this way, it is possible to have turnover data for both estimation quarters, even if the firm was not in the sample at the occasion t-4. The estimates of the change between the occasion t and the occasion t-4 are both computed on the new sample updated to the last year (Chianella *et al.,* 2015). It means that all observations are stratified in the same way over the two estimation quarters, according to the latest information available on the stratification variables. The rotated units are not included in the estimates, neither in the quarter t nor in the quarter t-4. Let g the unknown growth rate for the turnover in the population:

$$g = (G-1) = \left(\frac{Y_t}{Y_{t-4}} - 1\right)$$

Four estimators of $\hat{G}$ are presented for the estimate of the year-over-year growth rate of the turnover (Table 1).

---

[2] You can find useful information about the survey and the methodological note here: https://www.istat.it/it/archivio/fatturato+services

Table 1 – *Estimators used for the turnover growth rate estimation.*

Estimator of G	All respondent units	Only overlapping respondent units
Ratio of sample means	$\hat{G}_{all}$	$\hat{G}_{olp}$
Ratio of estimated totals	$\hat{G}_{all.cal}$	$\hat{G}_{olp.cal}$

Let r_1 be the set of the respondent enterprises only at the occasion t-4, r_2 the set of respondent enterprises in overlap between the occasions t-4 and t, r_3 the set of respondent enterprises only at the occasion t. Then we define $r_{12} = r_1 \cup r_2$ and $r_{23} = r_2 \cup r_3$:

1. $\hat{G}_{olp}$ is based on the ratio of the sample means calculated by using turnover data on the overlapping respondent units (r_2) between the two quarters:

$$\hat{G}_{olp} = \frac{\hat{Y}_{olp}^t}{\hat{Y}_{olp}^{t-4}} = \frac{\hat{\bar{y}}_{r_2}^t}{\hat{\bar{y}}_{r_2}^{t-4}}$$

2. $\hat{G}_{all}$ is based on the ratio of the sample means calculated using turnover data on all respondent units over the two quarters:

$$\hat{G}_{all} = \frac{\hat{Y}_{all}^t}{\hat{Y}_{all}^{t-4}} = \frac{\hat{\bar{y}}_{r_{23}}^t}{\hat{\bar{y}}_{r_{12}}^{t-4}}$$

3. $\hat{G}_{olp.cal}$ is based on the ratio of the estimated total of the turnover for the quarter t and for the quarter t-4, calculated using turnover data on the overlapping respondent units between the two quarters and through calibration (Deville and Sarndal, 1992) of the design weights:

$$\hat{G}_{olp.call} = \frac{\hat{Y}_{olp.cal}^t}{\hat{Y}_{olp.cal}^{t-4}} = \frac{\sum_{j \in r_2} y_j^t w_j}{\sum_{i \in r_2} y_i^{t-4} w_i}$$

4. $\hat{G}_{all.cal}$ is based on the ratio of the estimated total of the turnover for the quarter t and the quarter $t - 4$, calculated using turnover data on all respondent units over the two quarters and through calibration of the initial weights:

$$\hat{G}_{all.call} = \frac{\hat{Y}_{all.cal}^t}{\hat{Y}_{all.cal}^{t-4}} = \frac{\sum_{j \in r_{23}} y_j^t w_j}{\sum_{i \in r_{12}} y_i^{t-4} w_i},$$

the calibrated weights (w_j and w_i) associated with the same unit on the two survey occasions of investigation (t and $t - 4$) can be different due to the different non-response on the two occasions (the sets of respondent enterprises r_{12} and r_{23} are not the same). The ISTS uses for some domain estimations the estimator $\hat{G}_{olp}$ while for others the estimator $\hat{G}_{all.call}$ (Chianella *et al.,* 2013, Bacchini *et al.,* 2014, Bacchini *et al.,* 2015). In this work the estimators $\hat{G}_{olp.cal}$ and $\hat{G}_{all}$ are also analysed. The calibration variable used in the estimators $\hat{G}_{all.call}$ and $\hat{G}_{olp.call}$ is

the annual turnover, due to its high correlation with the variable of interest. The values of the calibration variable and the known totals are the same in both the numerator and the denominator, and derive from the latest available Asia together with integration on sample data. Calibration is performed at single stratum level, i.e. the known totals are calculated for each stratum.

3. Which is the best estimator?

To decide which estimator has to be used, it is necessary to analyze their variance. The estimators presented in Section 2, are ratios between two estimates at different occasions (for brevity, let us denote them in a general way by $\hat{G} = \hat{Y}^t / \hat{Y}^{t-4}$). Since $\hat{G}$ is a non-linear function of linear estimators, the computation of his variance can be performed using the Taylor series approximation. The result that is obtained is as follows:

$$Var(\hat{G}) = \frac{1}{(Y^{t-4})^2}\{Var(\hat{Y}^t) + G^2 Var(\hat{Y}^{t-4}) - 2Gcov(\hat{Y}^{t-4}, \hat{Y}^t)\}.$$

The variance terms in the above equation correspond to the variance of the total estimator (within the $\hat{G}_{olp}$ and $\hat{G}_{all}$ estimators we multiplied numerator and denominator by the number of units in the population (N) from which the sample is extracted). The difference between $Var(\hat{G}^{olp})$ and $Var(\hat{G}^{all})$, lies in the different number of units involved in the estimation: in the case of the $\hat{G}_{olp}$ estimator, only the number of units in overlapping between t and t-4 (n_c) is considered. We have:

$$Var(\hat{Y}_{all}^q) = N^2 Var(\hat{\bar{y}}_{all}^q) = N^2 \left(\frac{1}{n} - \frac{1}{N}\right) S_{1Y}^2 \ ,$$

$$Var(\hat{Y}_{olp}^q) = N^2 Var(\hat{\bar{y}}_{olp}^q) = N^2 \left(\frac{1}{n_c} - \frac{1}{N}\right) S_{2Y}^2 \ .$$

$Var(\hat{Y}_{all}^q)$ and $Var(\hat{Y}_{olp}^q)$ can be estimated substituting S_{1Y}^2 and S_{2Y}^2 (calculated on the entire population) with their estimate, calculated on the extracted sample. When using the $\hat{G}_{all.cal}$ and $\hat{G}_{olp.cal}$ estimators, the estimation of the total turnover is computed by calibration estimator. In this case, the variance of the total turnover in the generic quarter q can be approximated to the variance of the generalized regression model (see Righi *et al.,* 2005). Denoting by $z_j = y_j - x_j\beta$ the residuals of a regression model of Y (quarterly turnover data) on X (calibration variable), we define Z as the estimator of the total residuals. Therefore, we can write:

$$Var(\hat{Y}_{all.cal}^q) \cong Var(\hat{Z}_{all}^q) = N^2 \left(\frac{1}{n} - \frac{1}{N}\right) S_{1Z}^2 \ ,$$

$$Var(\hat{Y}_{olp.cal}^q) \cong Var(\hat{Z}_{olp}^q) = N^2 \left(\frac{1}{n_c} - \frac{1}{N}\right) S_{2Z}^2$$

S_{1Z}^2 and S_{2Z}^2 represent the variance of the residuals computed on the population. An estimate of $Var(\hat{Y}_{all.cal}^q)$ and $Var(\hat{Y}_{olp.cal}^q)$ can be given estimating S_{1Z}^2 and S_{2Z}^2 on the sample observations:

$$\hat{S}_{1Z}^2 = \frac{1}{n-1}\sum_{i \in s}(z_i^q g_i^q - \bar{\bar{z}}^q)^2 ; \quad \hat{S}_{2Z}^2 = \frac{1}{n_c-1}\sum_{i \in s}(z_i^q g_i^q - \bar{\bar{z}}^q)^2$$

where g_i is the design weight correction factor associated with the i-th unit in the calibration process and $\tilde{z}$ is the mean of $z_i g_i$. For the computation of the covariance term, under the assumption of a fixed population (*N*), sample size (*n*) and overlapping rate between the two occasions ($o = n_c/n$), as well as of the same stratification (h) over time, the results of Tam (1984) and Qualité and Tillé (2008) have been easily derived (Andersson *et al.,* 2011). We obtain:

$$Cov(\hat{Y}_{all}^{t-4}, \hat{Y}_{all}^t) = N^2 \left(\frac{o}{n} - \frac{1}{N}\right) S_{Y^t, Y^{t-4}}$$

$$Cov(\hat{Y}_{olp}^{t-4}, \hat{Y}_{olp}^t) = N^2 \left(\frac{1}{n_c} - \frac{1}{N}\right) S_{Y^t, Y^{t-4}}$$

$$Cov(\hat{Y}_{all.cal}^{t-4}, \hat{Y}_{all.cal}^t) \cong Cov(\hat{Z}_{all.cal}^{t-4}, \hat{Z}_{all.cal}^t) = N^2 \left(\frac{o}{n} - \frac{1}{N}\right) S_{Z^t, Z^{t-4}}$$

$$Cov(\hat{Y}_{olp.cal}^{t-4}, \hat{Y}_{olp.cal}^t) \cong Cov(\hat{Z}_{olp.cal}^{t-4}, \hat{Z}_{olp.cal}^t) = N^2 \left(\frac{1}{n_c} - \frac{1}{N}\right) S_{Z^t, Z^{t-4}}.$$

The covariance within each estimation domain can be computed as the sum of the covariance calculated in the individual strata, due to the hypothesis of the same stratification over time. An estimation of $Cov(\hat{Y}_{all}^{t-4}, \hat{Y}_{all}^t)$ and $Cov(\hat{Y}_{olp}^{t-4}, \hat{Y}_{olp}^t)$ can be given estimating by the sample, the covariance between the quarters on the overlapping observations. Similarly, an estimate of $Cov(\hat{Y}_{all.cal}^{t-4}, \hat{Y}_{all.cal}^t)$ and $Cov(\hat{Y}_{olp.cal}^{t-4}, \hat{Y}_{olp.cal}^t)$ can be given estimating $S_{Z^t, Z^{t-4}}$ on the sample, by the formula:

$$\hat{S}_{Z^t, Z^{t-4}} = \frac{1}{n_c-1}\sum_{i \in s}(z_i^t g_i^t - \tilde{z}^t)(z_i^{t-4} g_i^{t-4} - \tilde{z}^{t-4}).$$

Knottnerus (2012) compares $Var(\hat{G}_{all})$ with $Var(\hat{G}_{olp})$. He finds the overlapping value (*o*) for which $Var(\hat{G}_{olp}) = Var(\hat{G}_{all})$. Above this value, the estimator $\hat{G}_{olp}$ performs better than the estimator $\hat{G}_{all}$. When we use calibration ($\hat{G}_{olp.call}$ and $\hat{G}_{all.cal}$ estimators), the procedure is the same used by Knottnerus, but the calculation must be made on the residuals of the generalized regression model. Sufficient condition for which $Var(\hat{G}_{olp.cal}) > Var(\hat{G}_{all.cal})$ is that $S_{Z^t, Z^{t-4}} < 0$ or $o < \frac{S_{Z^t - GZ^{t-4}}^2}{2GS_{Z^{t-4}, Z^t}}$ provided that $S_{Z^{t-4}, Z^t} > 0$.

4. Simulation study

A simulation study was conducted with the aim of analyzing the performance of these estimators. A population of N= 8360 units has been generated (without stratification) with turnover possessing a lognormal distribution with parameters (mean and variance) able to reproduce the population observed in the sector of Accommodation, in the size class between 2 and 5 employees. The population generated represents the universe at the occasion t-4. A calibration variable has been created according to the desired correlation with the interest variable Y^t. The created calibration variable has the same values for both occasions t and t-4. This make the simulation as similar as possible to the estimation process used for the estimation of the change in the service sector turnover in Istat. The sample size is calculated from the population at the occasion t-4, by means of the Bethel algorithms implemented in Mauss-R. The planned coefficient of variation for the estimation of the total turnover has been fixed at 3%. The result is a sample size of $n = 417$ units but a random non-response of 30% of the units in the sample has been applied in both occasions. This only serves to decrease the sample size and increase the variance of the growth rate estimation, to make it similar to what is likely to occur in the survey. The theoretical standard deviations of the turnover growth rate ($Se(\hat{g})$) were computed using each of the four estimators described in Section 2, together with: 1) Different correlation values (0.97, 0.92 and 0.86) between the study variable on the two survey occasions Y^t and Y^{t-4}. A higher/lower correlation is achieved by decreasing/increasing the variability of the data in Y^t. 2) Different values of the overlap (variable "o") between the units responding at the occasion t and the units responding at the occasion t-4. In particular, the results have been analyzed by considering overlapping of 5%, 10%, 15%, 20%, 25%, 30%, 50%, 70%, 99%. 3) Different values of the correlation between the variable of interest and the calibration variable. In particular, the results have been analyzed by considering correlation coefficient values *rho*=0, 0.5, 0.6, 0.7, 0.8, 0.9, 0.95, 1. For reasons of space, these values are reported only for correlation values on the study variable between t and t-4, equal to 0.97 and 0.86 (Table 1 and 2). Since $g = (G - 1) * 100$, we have that $Var(\hat{g}) = 100^2 Var(\hat{G})$ and then $Se(\hat{g}) = \sqrt{Var(\hat{g})}$. The tables also show the overlap thresholds (o) below which $Se(\hat{g}_{olp}) > Se(\hat{g}_{all})$ and $Se(\hat{g}_{olp.cal}) > Se(\hat{g}_{all.cal})$. For easier viewing in the tables, standard deviations below this threshold are colored in blue. As we can see from the results of the calculation of the standard deviations, when the overlap of the respondent units between the occasions increases, the standard deviation of all estimators decreases. This is in accordance with the sampling theory, because the variance of the change takes minimum value in the case of complete overlap (Kish, 1965, pp. 457-466). The standard deviations of the $\hat{g}_{all}$ and $\hat{g}_{olp}$ estimators

are the same for each rho value because they do not need calibration. Using calibration we obtain the best results, therefore we have that $Se(\hat{g}_{all.cal}) \leq Se(\hat{g}_{all})$ and that $Se(\hat{g}_{olp.cal}) \leq Se(\hat{g}_{olp})$ for each rho $\neq 0$ and for every overlap value. In particular, the greatest improvement is obtained when using the estimators based on all respondents ($\hat{g}_{all.cal}$ VS $\hat{g}_{all}$), while we observed only a limited improvement when using the estimators based on the overlap respondents ($\hat{g}_{olp.cal}$ VS $\hat{g}_{olp}$).

Table 2 – *Standard deviation for the estimation of the growth rate g. Simulation 1:cor(x,y)=0.97.*

overlap	rho=0				rho=0.7			
	calibration		no calibration		calibration		no calibration	
	Gall.cal	Golp.cal	Gall	Golp	Gall.cal	Golp.cal	Gall	Golp
0.05	6,6	5,1	6,6	5,2	4,7	5,0	6,6	5,2
0.10	6,4	3,7	6,4	3,6	4,6	3,6	6,4	3,6
0.15	6,3	3,0	6,3	3,0	4,6	2,9	6,3	3,0
0.25	5,9	2,3	5,9	2,3	4,3	2,3	5,9	2,3
0.30	5,7	2,1	5,7	2,1	4,1	2,1	5,7	2,1
0.50	4,9	1,6	4,9	1,6	3,5	1,6	4,9	1,6
0.70	3,8	1,4	3,9	1,4	2,8	1,3	3,9	1,4
0.99	1,3	1,1	1,3	1,1	1,2	1,1	1,3	1,1
O		0.03		0.03		0.06		0.03
overlap	rho=0.9				rho=0.95			
	calibration		no calibration		calibration		no calibration	
	Gall.cal	Golp.cal	Gall	Golp	Gall.cal	Golp.cal	Gall	Golp
0.05	3,0	5,0	6,6	5,2	2,3	4,9	6,6	5,2
0.10	3,0	3,6	6,4	3,6	2,3	3,6	6,4	3,6
0.15	2,9	2,9	6,3	3,0	2,2	2,9	6,3	3,0
0.25	2,7	2,2	5,9	2,3	2,1	2,2	5,9	2,3
0.30	2,6	2,0	5,7	2,1	2,1	2,0	5,7	2,1
0.50	2,3	1,6	4,9	1,6	1,8	1,6	4,9	1,6
0.70	1,9	1,3	3,9	1,4	1,6	1,3	3,9	1,4
0.99	1,1	1,1	1,3	1,1	1,1	1,1	1,3	1,1
o		0.15		0.03		0.29		0.03

In this last case, the use of calibration leads to a smaller improvement because we have the same calibration variable (*X*) for both occasions (t and t-4) together with a low variability of X. In fact, in Table 2, where the variability of X is higher, the standard deviation values of $\hat{g}_{olp.cal}$ tend to be smaller than those of the $\hat{g}_{olp}$ estimator. When using calibration, to a higher rho value corresponds a higher overlap value over which $Se(\hat{g}_{olp.cal}) < Se(\hat{g}_{all.cal})$. This threshold also increases when the correlation between Y^t and Y^{t-4} decreases (with or without calibration). In fact, if we compare the tables, we can notice that the colored part becomes gradually larger in Table 2. The bias, the standard deviation and the mean squared error have been also analyzed through 1000 different samples extracted from the population. The absolute bias calculated from the 1000 estimates is very small. In fact, for most cases the bias is approximately equal to 0. For each estimate, a t-

Student distribution was used, and the corresponding 95% confidence intervals were calculated. The actual coverage probability of such confidence intervals is computed via simulation as the proportion of simulated confidence intervals that contain the true value of the growth rate g. As expected, the actual coverage probability is close to its nominal value, i.e. 95%. However, smaller values are obtained if the $\hat{g}_{olp}$ and the $\hat{g}_{olp.cal}$ estimators are used. In this case, especially for small overlap levels (5-10%), the coverage probability is approximately 90%. This is due to the fact that with low levels of overlap, the estimates were calculated on a small number of units (n_c). For example, with an overlap of 5%, only 15 units were used for the estimation. The simulation study was repeated in the case of stratified sampling design. Conditions very similar to those found in the ISTS were replicated: a level of overlap between the two occasions of about 70 percent, a high correlation between the variable of interest and the calibration variable (about 0.95) and a very high correlation between the observations on the two different occasions (about 0.98).

Table 3 – *Standard deviation for the estimation of the growth rate g. Simulation 3: cor(x,y)=0.86.*

| overlap | rho=0 | | | | rho=0.7 | | | |
| | calibration | | no calibration | | calibration | | no calibration | |
	Gall.cal	Golp.cal	Gall	Golp	Gall.cal	Golp.cal	Gall	Golp
0,05	7.0	12.1	6.9	12.3	5.3	11.4	6.9	12.3
0,10	6.8	8.7	6.8	8.7	5.1	8.2	6.8	8.7
0,15	6.6	7.1	6.6	7.1	5.1	6.7	6.6	7.1
0,25	6.3	5.5	6.2	5.4	4.7	5.2	6.2	5.4
0,30	6.1	5.0	6.1	5.0	4.7	4.7	6.1	5.0
0,50	5.4	3.9	5.3	3.8	4.2	3.6	5.3	3.8
0,70	4.5	3.3	4.4	3.2	3.7	3.1	4.4	3.2
0.99	2.8	2.7	2.8	2.7	2.6	2.6	2.8	2.7
o		0.17		0.17		0.30		0.17
overlap	rho=0.9				rho=0.95			
	calibration		no calibration		calibration		no calibration	
	Gall.cal	Golp.cal	Gall	Golp	Gall.cal	Golp.cal	Gall	Golp
0.05	3.7	11	6.9	12.3	3.1	10.8	6.9	12.3
0.10	3.7	7.8	6.8	8.7	3.1	7.8	6.8	8.7
0.15	3.6	6.4	6.6	7.1	3.1	6.3	6.6	7.1
0.25	3.5	4.9	6.2	5.4	3.0	4.9	6.2	5.4
0.30	3.4	4.5	6.1	5.0	2.9	4.4	6.1	5.0
0.50	3.2	3.5	5.3	3.8	2.8	3.4	5.3	3.8
0.70	2.9	3.0	4.4	3.2	2.7	2.9	4.4	3.2
0.99	2.5	2.4	2.8	2.7	2.4	2.4	2.8	2.7
o		0.74		0.17		1.0		0.17

Table 3 contains the summary statistics about the generated population for the occasion t and t-4. The coefficient of variation needed to calculate the sample size is set at 3 percent for the total estimation domain (not within each stratum). The bias and the standard deviation have been also analyzed through 300 different

samples extracted from the population. Compared with the previous simulation fewer replications were made since the population is larger (N=19,889). As we can see from Tables 4 and 5, the estimators have a strong bias and standard deviation within the strata. Stratum 4 is an exception, because it is a census stratum. Instead, within the estimation domain the bias is nearly 0 for all the estimators except for the estimator G_{all} (1.1 p.p.). Standard deviations within the estimation domain are smaller than the ones within the strata. The best estimators are $\hat{G}_{olp.cal}$ and $\hat{G}_{olp}$. For these estimators, the mean squared error within the estimation domain is the same. This is probably due to the low variability of the calibration variable within the strata, which makes the calibrated weights very similar to the design weights.

Table 4 – *Summary statistics of the simulation in case of stratification of the population*

Strata	N	n	Samplinng fract.%	nr	o	nc	Cor(Yt,Yt-4)	Growth rate g%
1	8,413	30	0.4	21	1	14	0.98	-10.1
2	9,885	140	1.4	98	1	69	0.97	-9.8
3	1,456	83	5.7	58	1	41	0.98	-9.6
4	135	135	100	95	1	66	0.95	-9.2
Total	19,889	388	2	272	1	190	0.98	-9.7

Table 5 – *Bias (p.p) and SD calculated on 300 sample estimates for the growth rate g.*

Stratum/Domain Bias	calibration		no calibration	
	Gall.cal	Golp.cal	Gall	Golp
Bias				
Stratum1	1.5	-0.4	4.7	-0.5
Stratum2	0.1	-0.2	0.7	-0.2
Stratum3	0.4	0.1	1.6	0.2
Stratum4	0	0	0	0
Domain	0.2	-0.1	1.1	-0.2
SD				
Stratum 1	14.7	5.7	26.2	5.9
Stratum 2	4.2	2.7	8.7	2.8
Stratum 3	5.4	3.1	11.2	3.2
Stratum 4	2.2	1.8	5.2	1.8
Domain	2.8	1.5	5.4	1.5

5. An application to the service turnover survey data

The application was performed on 2 different domains corresponding to two different economic activities. The first domain (D1) consists of four different estimation domains (G1, G2, G3, G4). The second domain (D2) consists of two different estimation domains (G5 and G6). Each domain estimation (G1, G2, G3, G4, G5 and G6) is divided into four independent strata according to the class of employees, with the exception of one estimation domain (G1), which is instead

divided into three independent strata. The stratum 4 (with more than 100 employees) within each estimation domain is the self-representative stratum. The application has been conducted on a given estimation quarter (which is not specified here). The estimators used for the growth rate estimation are those described in the previous chapter ($\hat{g}_{d,olp}$, $\hat{g}_{d,all.cal}$, $\hat{g}_{d,olp.cal}$). Since, as seen from the simulation study, the estimator $\hat{g}_{d,all}$ gives the worst results in terms of standard error of the growth rate estimation, it has not been used in the present application. The sample correlation between the variable of interest and the calibration variable (rho) is very high (0.99 for the domain D1 and 0.96 for the domain D2). Standard errors have been calculated using the Taylor series approximation. These values were compared with those obtained using the bootstrap method. Using the method proposed by Holmberg (1998), three artificial stratified populations (U_t^*, $U_{t,t-4}^*$ and U_{t-4}^*) were created and 300 bootstrap samples were generated from the artificial resampling populations in such a way that the overlapping of the units between the two quarters is the same as the parent sample, within each stratum.

Table 6 – *Standard error of the growth rate estimation for some estimation domains.*

| Domain/Group | Overlap | Taylor series Approximation | | | Bootstrap method | | |
		$\hat{S}e(\hat{g}_{olp})$	$\hat{S}e(\hat{g}_{all.cal})$	$\hat{S}e(\hat{g}_{olp.cal})$	$\hat{S}e(\hat{g}_{olp})$	$\hat{S}e(\hat{g}_{all.cal})$	$\hat{S}e(\hat{g}_{olp.cal})$
G1	0.84	1.4	1.3	1.2	1.1	1.1	1.0
G2	0.78	1.4	1.3	1.3	1.3	1.2	1.3
G3	0.82	1.1	1.0	0.7	0.8	0.7	0.7
G4	0.74	1.2	1.3	1.0	1.1	1.2	1.1
D1	**0.79**	**1.0**	**0.9**	**0.8**	**0.8**	**0.8**	**0.7**
G5	0.72	0.9	1.9	0.9	0.8	1.7	0.9
G6	0.70	0.7	1.7	0.7	0.6	1.4	0.7
D2	**0.71**	**0.8**	**1.5**	**0.7**	**0.7**	**1.4**	**0.7**

The results for the standard error are shown in Table 6. The results obtained with the bootstrap method in terms of standard errors are quite close to those obtained with the Taylor series approximation. Observing the results obtained through the Taylor series approximation, the best results are obtained with the use of the estimator $\hat{g}_{olp.cal}$.

6. Conclusion

The simulation study and the application show that given the characteristics of the ISTS, the estimator with the smallest standard errors is the calibration estimator calculated on the overlapping sample units in both quarters. The mentioned characteristics are: a high overlapping level (above 70%), a high correlation

between the variable of interest and the calibration variable (greater than 0.95) and a very high correlation between the observations in the two occasions. In addition, using the computed standard errors, it was possible to calculate a confidence interval associated with the change in turnover in some of the estimation domains for the ISTS, allowing the accuracy of the estimate produced to be measured.

References

ANDERSSON C., ANDERSSON K., LUNDQUIST P. 2011. "Estimation of change in a rotation panel design", *Proc. 58th World Statistical Congress*, Dublin.

BACCHINI F., BUSANELLO G., CHIANELLA D., CINELLI R.D., IANNACCONE R., QUONDAMSTEFANO V. 2015. Recent developments for quarterly service turnover indices, *Rivista italiana di statistica ufficiale,* No.1, pp. 21-49.

BACCHINI F., CECCARELLI C., CHIANELLA D., IANNACCONE R. 2014. Improving quarterly index of turnover by means of a calibration estimator, *RIEDS*, Vol. 68, No.1, pp. 15-22.

BARCAROLI G., BUGLIELLI D., DE VITIIS C. 2010. *MAUSS-R: user and methodological manual*, Istat, Roma.

CECCARELLI C., CHIANELLA D., DE FILIPPO F., GRAZIANI C., GUANDALINI A., LATTANZIO M., LORIGA S., MARTINI A., DIONISIO TERRIBILI M. 2017. Quality improvements in variance estimation for the labour force survey, *RIEDS*, Vol. 71, No.4, pp. 15-25.

CHIANELLA D., CINELLI R.D., QUONDAMSTEFANO V. 2013. I nuovi indici del fatturato dei servizi: Aspetti metodologici e piano di campionamento, In *Proceedings of the Istat seminar on short-term indicators of prices for the production of services and turnover of services*.

CHIANELLA D., IANNACCONE R., IACONELLI B. 2015. An Estimator for the Growth Rates in Short-Term Business Statistics Using Calibration. *Scientific Poster presented at the JOS 30th Anniversary Conference Statistics Sweden.*

DEVILLE J.C., SARNDAL C.E. 1992. Calibration estimators in survey sampling, *Journal of the American Statistical association*, Vol.87, pp. 376-382.

HOLMBERG A. 1998. A bootstrap approach to probability proportional to size sampling, In *Proceedings of the survey research methods section of the American Statistical Association*, pp. 378-383.

KISH L. 1965. *Survey Sampling*. Hoboken: John Wiley & Sons, Inc.

KNOTTNERUS P. 2012. On aligned composite estimates from overlapping samples for growth rates and totals. *Discussion paper CBS, Statistics Netherlands*.

MORETTI D., PAUSELLI C., RINALDELLI C. 2005. La stima della varianza campionaria di indicatori complessi di povertà e disuguaglianza, *Statistica Applicata*, Vol. 17, No.4, pp 529-549.

QUALITÉ L., TILLE Y. 2008. Variance estimation of changes in repeated surveys and its application to the Swiss survey of value added, *Survey Methodology,* Vol. 34, No.2, pp. 173-181.

RIGHI P., SOLARI F., FALORSI S. 2005. Stime ed errori, *Note Metodologiche,* Istat, Roma.

TAM S.M. 1984, On covariance from Overlapping Sample, *The American Statistician*, Vol. 38, No.4, pp.288-289.

WOLTER K. M. 1985. *Introduction to variance estimation*. New York: Springer-Verlag.

SUMMARY

The aim was to compute the variance of the estimators currently used in the service turnover survey for the quarterly turnover growth rate estimation and identify the best estimator. The survey uses two indicators for the estimation of the growth rate. The first one is a ratio between two mean estimators and is calculated on the set of respondents common to both quarters ($\hat{G}_{olp}$). The second estimator is instead the ratio between two totals in two different occasions, calculated using the calibration estimator. This second estimator is applied to the whole set of respondents in both periods ($\hat{G}_{all.cal}$). Since both estimators are non-linear function of linear estimators, the first-order Taylor approximation was used to compute the variance. To identify the best estimator, a simulation study has been conducted: two populations referred to two different occasions were generated and 1,000 samples were extracted. Therefore, it was possible to compute the bias, the standard deviation and the mean squared error for the estimation of the turnover growth rate. The analysis was performed for different sample overlapping values between the two reference quarters and different correlation values between the variable of interest and the calibration variable, together with different correlations of the variable of interest between the two occasions. An application performed on real data was also conducted, using information from the quarterly service turnover survey. The confidence intervals associated with the year-over-year variation of the quarterly service turnover were calculated for some estimation domains. The standard errors obtained by using Taylor first-order series approximation were compared with the ones obtained with the bootstrap method. The comparison shows similar results.

_____

Diego CHIANELLA, Istat, chianella@istat.it

SURVEYS ON TRADE SECTOR: A COMPARISON BETWEEN QUALITATIVE AND QUANTITATIVE INDICATORS[1]

Maria Rita Ippoliti, Luigi Martone, Fabiana Sartor, Graziella Spera

1. Introduction

Qualitative surveys are extremely relevant for the short-term economic analysis and exceptionally useful in the building process of cyclical indicators of the economic development as they gather information quickly and explore topics that are not investigated by quantitative surveys. Therefore, these variables are often considered complementary to official macroeconomic data, and they are both used for analysing the short-term economic development. This approach underlines the important role of assessments and expectations for the economic decision makers. As qualitative series are so important for policy makers, it is necessary to assess the reliability of results of qualitative surveys, measuring the distance with official quantitative series and estimating the similarity of signals coming from qualitative surveys and short-term movement in the economic activity (Koopmans, 1947; Zarnowitz, 1992). There has been much debate on this topic in the economic literature, mainly with regard to the manufacturing sector, while the discussion remained poor concerning the other economic sectors, such as services, trade and construction (Crosilla and Leproux, 2007; Crosilla *et al.*, 2009; Martelli and Rocchetti, 2007). This paper investigates the trade sector, comparing the evolution of business confidence in retail trade with two quantitative indicators, which measure the different sectors of section G: retail trade (Division 47) and turnover in services (Division 45) from 2010 until 2019. Business confidence in trade sector involves enterprises classified in the NACE Rev. 2 section G[2], apart from the wholesale trade classified in Division 46, the itinerant retailers classified in Group 47.8 and non-store retailers, stalls and markets classified in the 47.9. The aim of the project is to assess the relationship between qualitative and quantitative

---

[1] Though the article is the result of a joint work, the single paragraphs are attributed as follows: paragraph 1 and 2.2 to Fabiana Sartor; paragraph 2 to Graziella Spera; paragraph 3 and 4 to Luigi Martone; paragraph 5 and 6 to Maria Rita Ippoliti. The published articles are exclusively expressing the authors' opinions; Istat shares no responsibility for the published contents.

[2] Section G includes Division 45 (Wholesales trade, retail trade and maintenance of motor vehicles), Division 46 (Wholesales trade, except wholesales trade of motor vehicles) and Division 47 (Wholesales trade, except wholesales trade of motor vehicles).

components concerning the retail trade sector: analysing the trend in time series and testing the ability of the qualitative index to timely catch the economic development. Therefore, the present paper examines and compares official qualitative retail trade to test the reliability of qualitative series. In order to make the comparison more effective we purified the quantitative series from the long-term trend. This leaded us to use the seasonal difference of the logarithm of the quantitative series as a transformation to remove seasonality and trend from the quantitative series. However available data are insufficient to guarantee strong scientific evidence: considered time series are indeed short (Division 45 of turnover has been surveyed since 2010) and survey samples include different types of enterprises depending on the specific features of each survey (i.e. Retail trade survey struggles to keep track of store closures and openings). This paper proposes the development of a new quantitative index, based on appropriate transformations of the two quantitative indices and including all activity sectors covered by the qualitative indicator. This new ad hoc index interestingly leads to a higher correlation with the qualitative index and the application of ADL models and Granger causality test for a comparative analysis confirms the reliability of the new index. This study is structured as follows: paragraph 1 presents the background to the study, introducing the qualitative and quantitative surveys involved; paragraph 2 provides a description of methods and tools used, it presents a first graphic analysis comparing quantitative and qualitative indicators and it introduces a new "ad hoc" indicator covering all sectors involved in the business confidence. Paragraph 3 shows the cyclical analysis, focusing on turning points and cross-correlation. Paragraph 4 shows a further comparative analysis of the involved indicators, using ADL models and Granger causality test. Finally, the last paragraph presents our conclusions.

2. Trade surveys

2.1. *Business Confidence Survey in Retail Trade*

Business Confidence Survey in Retail Trade is part of a joint project harmonised at European level and coordinated by the European Commission, it allows to have information on the economic evolution of retail trade (NACE Division G, except for Division 46 - Wholesale trade, except of motor vehicles and motorcycles and for Group 47.9 - Retail trade not in stores, stalls or markets including retail sales via mail order or via Internet).[3] The survey asks enterprises to express their opinions (judgements and expectations over the following 3 months)

---

[3] Divisions of NACE Section G involved in the survey are Division 45 (Wholesale and retail trade and repair of motor vehicles and motorcycles) and Division 47 (Retail trade, except of motor vehicles and motorcycles).

about the main economic variables (orders, prices, employment), giving therefore an updated overview on the evolution of the sector. Respondents are requested to state their consideration on their total sales in the last three months, on their current volume of stock and on prices charged by their suppliers. They are also invited to express how they expect the volume of orders, the employment, the prices they charge and total sales to change in the next three months. Information about enterprises of the Business Confidence Survey in Retail Trade are taken from a panel of approximately 1.000 commercial enterprises. The theoretical sample is stratified by enterprise employment size class (1-2 employees, 3-5; 6-999; at least 1.000 employees), by geographical area (North-West, North-East, Centre, South and the Islands) and by main activity (45.1 sales of motor vehicles; 45.2-45.4 maintenance of motor vehicles and sales of accessories; 47.1, 47.2 retail sales of food, drinks and tobacco; 47.3 retail sales of automotive fuel; 47.4-47.7 retail sales of other goods). The sampling scheme depends upon randomisation for enterprises with less than 1.000 employees and upon a census placement for all units with 1.000 employees and above. The data processing method sets out the estimate of the frequency percentages of each reply option relating to each item of the questionnaire. For this purpose, the processing of the micro data is based on a double weighting system: a) the frequencies of each reply option are firstly weighted using the number of employees declared by the enterprise at the time of the interview (internal weight); b) subsequently fixed weights reflecting the distribution of the added value of the reference sector (external weight) are used. Since March 2015, the aggregation procedure uses an external weighting structure derived from the added value at factor cost referred to 2012. Each variable is measured calculating balances as percentage differences between favourable and unfavourable responses. Weighted balances are seasonally adjusted if needed. The Index of Business Confidence in Retail Trade is calculated as the arithmetic mean of seasonally adjusted balances based upon opinions and expectations on sales and upon judgments on volume of stocks (the above-mentioned values have inverse signs).

2.2. Retail Trade Survey

Monthly Retail Trade Survey collects data from enterprises that mainly operate in the retail trade sector (except for sale of motor vehicles and motorcycles and sale of automotive fuel). Therefore, the survey covers the retail trade sector only partially (NACE Rev. 2, G 47 - Retail trade, except of motor vehicles and motorcycles not including automotive fuel)[4]. Data here considered include Nace

---

[4] According to NACE Rev. 2, Retail trade (Division G47) is first classified by type of sale outlet (retail trade in stores: groups 47.1 to 47.7; retail trade not in stores: groups 47.8 and 47.9). For retail

Group G 47.3, Retail sale of automotive fuel, which ISTAT does not disseminate at national level.[5] Estimates of Retail Trade Survey provide useful information on consumer spending. Monthly indices on retail trade are released at national level, consistently with the European Union Regulations concerning short-term statistics (see European Regulations n. 1165/98 and n. 1158/2005)[6]. Retail trade data are collected from a sample of about 8.000 enterprises having at least a legal unit that operates in Italy. The sample is stratified considering the following variables: main activity according to NACE Rev. 2 and employment size class (1-5, 6-49 and at least 50 employees). According to the sampling scheme, enterprises with less than 50 persons employed are selected at random, while any enterprise with equal or more than 50 persons employed is included in the survey. All the enterprises employing 50 or more persons add up to more than 1.100 units. The sampling design of the survey rotates some units out and rotates new units in each year (belonging to employment size classes 1-5 and 6-49 only) to share burden and refresh the sample. This aspect gains relevance when comparing retail trade indicators with qualitative data, as the Retail Trade Survey struggles to keep track of quick evolution of stores' closures and openings. According to their distribution channel, enterprises in the retail trade sample can be classified into large-scale distribution, small-scale distribution, internet sales and non-store sales. Within the weighting structure of Monthly Retail Trade Index (base=2015), large scale-distribution accounts for 46.4% of total turnover, while small-scale distribution reaches 48.0% of total turnover. Retail trade indices are calculated as weighted means of the sub-indices of each stratum. Concerning the calculation method of the indicator, the synthetic index numbers are constructed as weighted averages of indices related to the domains identified by the intersection of the stratification variables (main activity and employment size). To calculate aggregate indices up to the retail trade total, the Laspeyres index is used. The weights are based on turnover data from SBS of the year 2015. Value of sales indices measures the retail trade turnover over time at current prices and, therefore, incorporates the effects in changes of quantity sold and prices. In order to determine estimates on the volume of sales, value of sales indices is processed to allow removing price effects on turnover, using the Harmonised index of consumer prices (HICP). Monthly data are first revised in the following month after publication (which occurs 38 days past the reference time period). Estimates are then subject to a second revision, which occurs on annual basis and replaces the provisional estimates with the final indices.

---

sale in stores, there exists a further distinction between specialised retail sale (groups 47.2 to 47.7) and non-specialised retail sale (group 47.1).
[5] See Annex 1 for a list of involved surveys and covered Nace sectors.
[6] See https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1998R1165:20120621:EN:PDF

2.3. Turnover in Services Survey

Quarterly Turnover in Services Survey focuses on short-term dynamics of value of services sold by enterprises, which operate in the services field as a main economic activity. These dynamics incorporate growth rates of volumes and prices, giving a prompt information. The methodology, the breakdown and the frequency of releases are defined by the European Regulations on short-term statistics (see European Regulations n. 1165/98 and n. 1158/2005 and footnote 9). This is a sample survey, enterprises are the units of observation, while turnover and average number of persons employed by the economic unit in the reference quarter are the variables of interest. Quarterly indicators on turnover in services are calculated for each economic sector, setting 2015 as the base year; these indices are then aggregated according to the Laspeyres formula that uses a weighting structure reflecting the proportion of turnover by economic sector in the base year 2015. The survey does not include retail trade; however it includes retail trade of motor vehicles and motorcycles (NACE Rev. 2 Division G 45)[7]. The latter, which is the sector analysed in this study, hereafter will be referred to as FAS45; the sample for this survey includes 1.627 enterprises, starting from 2010. For this economic sector, the method applied to build domain indices first calculates the quarterly turnover levels using weights to estimate the population value from the sample. Then the growth rates are calculated. The weights used as expansion factors are obtained as the ratio between the total reference population (taken from Asia archive) and the sample size for each stratum.

3. Data analysis: tools and methods

Our first exercise investigates the relationship between FIDCOM and the two quantitative indicators VEN and FAS45. Results show that FIDCOM and VEN series diverged considerably in almost the entire period except for the last part, around 2019, when the two series appear to be aligned. Interestingly, FIDCOM and FAS45 show a slightly better alignment throughout the whole period. Dissimilarity between the two indices can be caused by the different sectoral coverage, by the different sampling scheme of the three surveys and by the different features of the seasonal component, which is higher in the Retail Trade Index. The comparison becomes more effective when the cyclical component of the reference economic variable is used; consequently, the quantitative series should be purified from the long-term trend. Although different detrending methods can present a good

---

[7] Sectors covered by the survey are: section G - Wholesale and retail trade and repair of motor vehicles and motorcycles (except division G47 - Retail trade), section H – Transportation and storage, section I – Accommodation and food service activities, J – Information and communication, L – Real estate activities, M – Professional, scientific and technical activities, N – Administrative and support service activities.

approximation, they do not estimate the same cyclical components (Canova, 1999), causing issues for an accurate estimate at the end of the reference time period. In the light of the above, in this exercise we used the seasonal difference of the logarithm of the quantitative series as a transformation to remove seasonality and trend from the quantitative series. Although this transformation can be seen as a rather simple method to remove these components from quantitative series, it also allows elimination of estimation problems at the end of the period; moreover, this approach represents the most used method in forecasting models (i.e. Bruno and Lupi, 2004). The different sectoral coverage emerged in the previous analyses made it necessary to create an ad hoc index (also referred to as ADHOC) involving both the surveyed sectors (Divisions 45 and 47), calculated as a weighted average of the two indices, where weights reflect the distribution of turnover across the different economic sectors (see Annex 1). The graphical analysis of FIDCOM and the cyclical component of the ADOCH index (Figure 1) reveals that the the two series tend to be significantly aligned keeping a small gap between them starting from year 2017.

Figure 1 – *Comparison between FIDCOM and ADHOC (quarterly data, seasonally adjusted, year 2010-2019)*
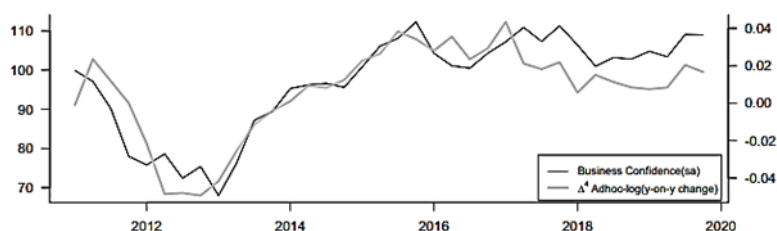
Source: Elaboration on ISTAT data.

In order to verify previous results, we calculated the correlation between FIDCOM and the logarithmic transformations of the three considered quantitative indices. Values in table 1 show that the correlation between business confidence and the new ad hoc index is higher (0.87) than the correlation between the indicators of each quantitative survey and Business Confidence Survey (VEN 0.43 and FAS45 0.79).

4. Cyclical analysis

For a more in-depth analysis of the comparison between the qualitative indicator of the survey on business confidence and the quantitative reference indicator, it is also useful to consider the behaviour of the series at turning points and the ability of the qualitative series to timely detect and sometimes anticipate

the turning points in the cyclical movement of the quantitative series. The Bry-Boschan method (1971) was used to detect turning points and to identify expansion and recession phases, catching the moments when the fluctuation of the business cycle changes in direction, from recessive to expansive (peak) and from expansive to recessive (trough). According to this approach, a business cycle is completed when it goes through a single expansion (minimum-maximum) and a single contraction (maximum-minimum) in sequence, therefore it is defined as the period between two troughs. The applied procedure searches for turning points observing the following constraints: each complete cycle lasts at least five quarters and each single cyclical phase (including alternation of expansive and recessive phases) lasts at least two quarters [8] Turning points that are too close to the extreme values of the series are excluded by the procedure. Table 1 shows the history of turning points detected by the procedure.

Table 1 – *History of turning points: VEN FAS45 and ADHOC (cyclical component) FIDCOM.*

	Δ ^{4}LogVen	Δ ^{4}LogFas	Δ ^{4}LogAdhoc	Confidence
Number of cycles	2	1	2	2
Number of turning points	6	3	5	5
N. of common turning points with Δ ^{4}LogVen	-	-	-	5
N. of common turning points with Δ ^{4}LogFas	-	-	-	3
N. of common turning points with Δ ^{4}LogAdhoc	-	-	-	5
Turning points				
Max				
Min	201301	201203	201204	201301
Max	201503	201602	201503	201504
Min	201603		201603	201603
Max	201701		201701	201704
Min	201801	201901	201901	201802
Max	201803			
Average lag(-)/lead(+)(in quarters)				
Compared to Δ ^{4}LogVen	-	-	-	-0.8
Compared to Δ ^{4}LogFas	-	-	-	2.3
Compared to Δ ^{4}LogAdhoc	-	-	-	-0.4
Agreement index				
Compared to Δ ^{4}LogVen	-	-	-	0.72
Compared to Δ ^{4}LogFas	-	-	-	0.67
Compared to Δ ^{4}LogAdhoc	-	-	-	0.78

Source: Elaboration on ISTAT data.

Because of the shortness of the series, the procedure detected only a small

---

[8] With regard to monthly series, constraints impose that each cycle lasts at least fifteen months and each cyclical phase lasts at least five months.

number of cycles (2 for VEN, ADHOC and FIDCOM and 1 for FAS45). Specifically, two complete FIDCOM cycles last approximately eleven quarters and they are composed by eight quarters of expansion and three quarters of contraction. Now and then, the FIDCOM cycle reproduces the reference series' turning points with a slight lag: averagely one-quarter lag when compared to VEN and two-quarter lead when compared to FAS45. Remarkably, this result suggests that, despite the little amount of available data, the correlation between the composite indicator and the qualitative indicator (having the same sectoral coverage) is higher than the correlation between the indicators of each quantitative survey and the qualitative indicator.

5. Econometric exercise

5.1. ADL MODELS

In order to compare qualitative and quantitative data, besides correlation method, it is possible to apply ADL models, forecasting models with autoregressive distributed lag such as

$$y_t = \alpha + \Phi(L)y_{t-1} + \beta(L)x_t + \varepsilon_t \tag{1}$$

where x_t is the indicator deriving from qualitative survey (confidence) and y_t is the quantitative variable (VEN, FAS45 or the ADHOC composite indicator). These models allow analysing the dynamic features of $\beta(L)$ and $\Phi(L)$, the effectiveness of the model, the structural stability (considering shortness of the available time series) and the forecasting ability of treated indicators. Table 2 shows the results of the three quantitative indicators while Figures 2 graphically represent recursive residuals.

Table 2 – *ADL models for a comparison between qualitative and quantitative data.*

| ADL model	Coef	P-value	R^2	F test	Box-Pierce test	Granger-test
VEN ~ L(VEN) + FIDCOM			0.77	0.00	0.58	0.10
VEN	0.9	0.00				
FIDCOM	0.01	0.14				
FAS45 ~ L(FAS45) + FIDCOM			0.97	0,00	0.26	0.00
FAS45	0.89	0.00				
FIDCOM	0.20	0.00				
ADHOC ~ L(ADHOC) + FIDCOM			0.97	0,00	0.16	0.00
ADHOC	0.93	0.00				
FIDCOM	0.05	0.00				

Source: Elaboration on ISTAT data.

ADL models allow examining the dynamic features of the coefficients related to the indicators involved in the model, therefore these models allow the analysis of the impact on quantitative indicator when qualitative indicator changes by one unit.

Given (1), then:

$$y_t = \frac{\beta(L)}{1 - \Phi(L)} x_t \tag{2}$$

where β(L) is the immediate effect (how much the quantitative indicator changes when the confidence indicator changes by one unit) and 1-Φ(L) is the measure of how fast the long-run effect emerges, which is given by the ratio between the two components. The latter depends on both the confidence indicator and VEN / FAS45 / ADHOC indicators at time t-1. Our results in Table 4 shows that FAS45 is the fastest indicator, as its immediate effect score is 0.20 while the score for VEN is 0.01 and the score for ADHOC is 0.06. Moreover, the long-run effect score for FAS45 is higher than the scores of other indicators (1.66 versus 0.11 for VEN and 0.75 for ADHOC). The analysis of the ability of models to accurately fit data reveals that the FAS45-FIDCOM model and the ADHOC-FIDCOM model fit better than the VEN-FIDCOM model (R2 0.97 versus 0.77). F test results are significant for all models. Furthermore, the surveys' structural stability was examined, acknowledging shortness of available time series, through recursive residuals test (see Figure 2).

Figure 2 – *Recursive residuals VEN, FAS45 and ADHOC*.
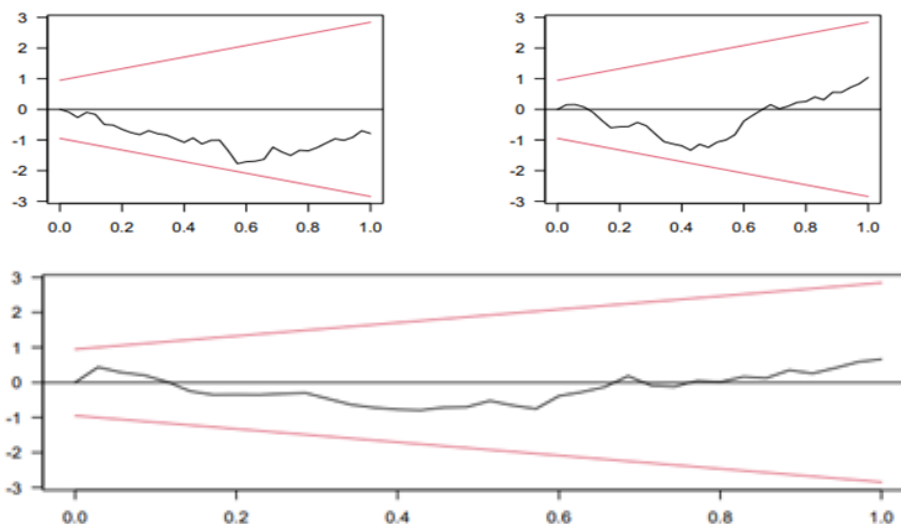
Source: Elaboration on ISTAT data

Graphs show that all indicators remain within the bands defined by the critical values (level α=0.05), ensuring the consistency of the parameters in the reference period. Finally, we analysed the ability of the qualitative series to forecast the quantitative series. In fact, if a series x_t causes series y_t, then past values of the first series should contain information that helps predict the second series. Results of this exercise show that time series of confidence in trade sector helps to predict future values of the FAS45 indicator and the ADHOC combination (p-value 0.0 for both of them), whereas it does not help in determining values for VEN (p-value 0.9). Acknowledging the purpose of this study focused on evaluating the performance of the new ad hoc indicator, despite the appreciable concordance between FIDCOM and FAS45, the result of the above-mentioned analysis emphasizes the validity of the ad hoc index.

5.2 Prediction of consumption in National Accounts

After analysing ADL models, it is useful to verify the forecasting ability of the treated indicators. We carried out a performance evaluation for VEN and ADHOC indicators referring to data on Household final consumption expenditure provided by National Accounts (CONS). Despite the shortness of the available time series, Granger causality test confirms that in trade sector the ADHOC indicator is successful in forecasting the retail trade indicator (*p-value* 0.03 versus 0.07). This finding validates the usefulness of a composite index, which performs better than the individual indicators and has a good predictive ability.

6. Conclusions and perspectives

Confidence surveys provide timely information on the short-term economic evolution for different economic sectors; they also are exceptionally useful in the building process of cyclical indicators of the economic development as they gather information quickly and explore topics that are not investigated by quantitative surveys. The study focuses on the comparison between the confidence index in trade sector and the equivalent quantitative indices: the Retail Trade Index and the Turnover in Services Index (Division 45 only, Wholesale and retail trade and repair of motor vehicles and motorcycles) concerning years 2010-2019. The analysis of the relationship between FIDCOM and the two quantitative indicators and the comparison between FIDCOM and the cyclical components of the quantitative indicators highlighted a good alignment among the different series, which diverged towards the end of the reference period. The diverse sectoral coverage made it necessary to create an ad hoc index (ADHOC) involving both the surveyed sectors (Divisions 45 and 47), calculated as a weighted average of the two indices, where weights reflect the distribution of turnover. The analysis revealed that the

qualitative series and the new ad hoc quantitative series were more aligned, keeping a smaller gap between them towards the end of the period. Moreover, the correlation found between business confidence in retail sector and the new ad hoc index was higher than the correlation between business confidence and the indicators of each quantitative survey. In order to investigate the ability of the qualitative indicator to timely detect movements or to predict fluctuations of the economic evolution, a turning points analysis was carried out. The results clearly show that expansive and recessive phases of the economic cycle are rather coincident between confidence index and the quantitative series. On the whole, FIDCOM appears to have a higher correlation with the cyclical movement of the ADHOC indicator. This evidence suggests that the correlation between a composite indicator and a qualitative indicator with the same sectoral coverage is higher than the correlation between a qualitative indicator and the indicators of each quantitative survey. In order to compare qualitative and quantitative data, besides correlation method, we applied ADL models and results show a good effectiveness of the considered models and a reliable structural stability of the surveys. Moreover, the Granger causality test revealed the ability of the trade confidence time series to predict future values of both FAS45 indicator and ADHOC combination, whereas it does not help in determining values for VEN. As a further econometric exercise, we assessed the ability of VEN and ADHOC indicators to predict data on Household final consumption expenditure provided by National Accounts. Our findings confirmed the ADHOC composite indicator to be successful in forecasting the retail trade series and to perform better than each individual indicator. Therefore, results proved that the ADHOC indicator helps to predict future values of data referred to our country's economic activity.

References

BRUNO G., LUPI C. 2004. Forecasting industrial production and the early detection of turning points, *Empirical Economics*, Vol. 29, No. 3, pp. 647-671.

BRY, G., BOSCHAN, C. 1971. Cyclical Analysis of Time Series: Selected Procedures and Computer Programs*, NBER Technical Papers*, National Bureau of Economic Research.

CANOVA, F. 1999. Does detrending matter for the determination of the reference cycle and the selection of turning points?, *The Economic Journal*, Vol. 109, No. 452, pp. 126–150.

CROSILLA L., LEPROUX S. 2007. Leading Indicators on construction and retail trade sectors based on ISAE survey data, *ISAE working papers,* Istituto di Studi e Analisi Economica.

CROSILLA L., LEPROUX S., MALGARINI M. e SPINELLI F. 2009. Model-based Confidence Indicators for the Italian Economy, *ISAE working papers*, Istituto di Studi e Analisi Economica.

KOOPMANS T. 1947. Measurement without theory. *Review of Economic Statistics*. Vol. 29, No. 3, pp. 161–172.

MARTELLI B.M. e ROCCHETTI G. 2007. Cyclical features of the ISAE business services series, *ISAE working papers*, Istituto di Studi e Analisi Economica.

MOORE, G.H. e SHISKIN J. 1967, Indicator of business expansion and contractions, *NBER Occasional Paper,* National Bureau of Economic Research.

ZARNOWITZ V. 1992. *Business Cycles, Theory, History, Indicators, and Forecasting*. Chicago*:* The University of Chicago Press.

SUMMARY

Data from qualitative surveys are often considered complementary to quantitative data when analysing the short-term economic evolution. This paper aims at investigating the retail trade sector, comparing data stemming from the different kinds of surveys conducted by Istat, providing qualitative and quantitative data on monthly and quarterly basis. This study compares the Retail Trade Confidence Index (NACE rev.2, G45 and G47), a business sentiment indicator, along with quantitative data from Retail Trade Survey (NACE rev.2 G47) and Turnover in Services Survey (NACE rev.2 G45) concerning years from 2010 through 2019. Despite the shortness of the available time series and the different features of the samples involved, interesting findings emerged when observing the performance of a new 'ad hoc' index (which was built including both the economic activities examined by the quantitative surveys) and when comparing the above-mentioned indicators applying ADL models.

_____

Maria Rita IPPOLITI, Istat, marippoliti@istat.it
Luigi MARTONE, Istat, martone@istat.it
Fabiana SARTOR, Istat, sartor@istat.it
Graziella SPERA Istat, grspera@istat.it

ISTAT ENUMERATION AREAS 2021: MAIN FEATURES

Fabio Lipizzi, Alberto Sabbi, Stefano Mugnoli, Germana Endennani, Marina Arcasenza[1]

1. Introduction

Census Map is the official cartographic support for collection and dissemination of the Italian population census data.

The Census Cartography (BT) represents an updated photograph of the territorial boundaries adopted (enumeration areas, inhabited locality and productive areas) which includes new urban development areas. The BTs are, therefore, the representation of geographic objects to describe both the settlement mosaic of the country and its evolution from the medium to long term, although with some approximation essentially due to census purposes. In any case, the definition of the Census Maps is strictly a matter for local authority. According to the provisions of art. 39 of the Presidential Decree 223/89, articles 9 and 10 of the Registry Law (Law 24 December 1954, n. 1228), Chapters VII and VIII of its Implementation (Presidential Decree 30 May 1989, n. 223), local authorities are obliged to update the Census Maps, taking into account all the changes of their territories (Istat, 1992).These activities are organized according to the provisions specified in the Italian General Census Plan, approved on 08/10/2020 and available on the website of the National Institute of Statistics. The main goal of the activity is to define a plot of the National territory connected to the changes that have occurred in terms of urban expansion and new building aggregates; and this, in order to disseminate permanent population census data.

As of 2018, the Italian population census survey has marked the definitive transition from the traditional "door-to-door" enumeration to a "register-based" system built on the so-called Permanent Population and Housing Census (UNECE, 2021).

The change in the census survey strategy has also modified the use of the Census Maps at Municipality level[2].

---

[1] Even if the paper was devised together by the authors, F. Lipizzi wrote paragraphs 1 and 6; S. Mugnoli wrote paragraphs 4 and 4.1; A. Sabbi wrote paragraphs 2.2 and 3. Arcasenza M. wrote paragraph 5; Endennani G. wrote paragraph 2, 2.1 and References.

In particular, the new edition of the 2021 Census Maps will not be used as a basis for census data collected in the year, but rather for the dissemination of the 2021 sub-municipal data. The Enumeration Areas (EAs), in fact, continue to distinguish in an exclusive way the phase of dissemination of statistical data at the minimum territorial level.

2. Main characteristics of the Enumeration Areas cartography and Microzones Project[3]

It is noteworthy that the new Enumeration Areas coverage, called "microzones", inherits the rules and geometric objects of the 2011 Census Maps; but to better spread sub-municipal data, it is necessary to improve the quality of the design and increase the internal homogeneity of the polygons. On the other hand, as in the occasion of the 1981 census surveys, it was emerging the idea of considering the Census Maps not only for instrumental purposes related to the census survey operations; in fact, even then it took place also the idea of taking advantage of their homogeneous characteristics under demographic, socio-economic profiles, urban planning, environmental and similar. This statement is a first important principle that strengthens the possibility of an analytical use of the subdivision of the territory linked to the statistical census data. In fact, the homogeneous characteristics of the Census Maps are the main prerequisite for the use of this huge information assets in a perspective aimed at a broader knowledge of the sub-municipal areas (Lipizzi, 2013).

2.1. Workflow of the Census Maps

The EAs 2021 have many new elements compared to the past, which however have not changed their main characteristics; it remains valid the municipal validation process that Istat planned in the past census surveys.

Therefore, summing up the process, Istat formulates a proposal to update the 2021 Census Maps. The proposal allows for a reduction in the operational burden of municipal administrations in the control activities. These have the sole task of validating the proposal and, if necessary, they can modify or supplement the maps.

---

[2] See the General Census Plan www.istat.it/it/files//2018/09/PGC-POPOLAZIONE-ABITAZIONI-2022.pdf.

[3] The finest classification of the new cartographies is that of "microzones". This base was built by identifying homogeneous land use and cover parts within the enumeration areas. In order to contain the operational burden that the municipalities will have to face during the validation of their own pieces of territorial cartographies, they were produced generalized geographic basis by simplifying the territorial plots and limiting the number of enumeration areas to be reviewed.

This operation makes it possible to obtain a design made with the same rules and homogeneous throughout Italy.

Subsequently, Istat verifies compliance with the requirements given and acquires the Census Maps revised by the local authorities.

2.2. *General rules for EAs-level construction*

The process of generating the new territorial base was elaborated by integrating EAs 2011 polygons with other thematic cartography (open and commercial ones). These cartographic sources were spatial mixed choosing a precise overlapping priority; then they were checked and geometrically cleaned by Istat technicians. The purpose of this operation is to add further characteristics to the EAs. The obtained layers became the subject of a photo-interpretation operation in order to verify the newer urban expansions (centers, inhabited areas and production locations).

During the data integration phases, the implementation of many GIS geoprocessing tools has speeded up the maps production process and improved their quality.

The overlapping methods are based on the properties of topological spaces and on the operations (inclusion and intersection) between geometric objects associated with them (for a discussion of the topological operations applied to GIS see Egenhofer and Franosa, 1991).

The general rule for the design of the new 2021 sections provides that new polygons are drawn only within a pre-existing EAs 2011. The new polygons is designed according to its importance on the territory, such as for airport areas, hospitals, schools, town halls, etc.

This new layer constitutes, therefore, the overcoming of the traditional census Enumeration Areas, used almost exclusively for census survey; it gain, however, some specific characteristics, which make it suitable for other purposes.

Therefore, the EAs 2021 have a greater territorial homogeneity and a new thematic detail. With these premises, one of the focal points for the correct definition of the EAs 2021 is the use of a classification system oriented towards objects permanently identified on the territory over time. Therefore, to summarize, each new EA 2021 is identified following a criterion of its internal homogeneity. After drawing, the polygon is classified on the base of a special type code (Cod_Tipo_S) which characterizes the area in terms of use and land cover.

In the past, EAs plot was mainly functional to the census survey; in fact, the polygon were drawn following the territorial distribution of the population: smaller and more compact in inhabited centers; larger in extra-urban areas.

In this new version of the Istat cartography, each EA 2021 are also drawn according to the two following definition:

- Land Cover means the biophysical coverage of the earth's surface[4], including artificial surfaces, agricultural areas, woods and forests, semi-natural areas, wetlands, water bodies, as defined by Directive 2007 / 2 / EC;

- Land use corresponds to the socio-economic description (functional dimension) of areas: areas used for residential, industrial or commercial purposes, for farming or forestry, for recreational or conservation purposes, etc.[5]

Despite the two terms are often used interchangeably, land use, is a reflection of the interactions between humans and land cover and therefore constitutes a description of how the soil is used in anthropogenic activities. Directive 2007/2 / EC defines it as a classification of the territory based on the functional dimension or socio-economic destination present and planned for the future (for example: residential, industrial, commercial, agricultural, forestry, recreational).

3. Some specific items of the EAs 2021 Istat cartography

Undoubtedly, the main items represented on Istat cartography are inhabited localities (Istat, 1992)

They can be divided into three categories:
- Urban centers (Centro abitato): groups of houses, distant from each other no further than 70 meters and connected by roads. They must have public services (schools, train stations, pharmacies, etc.);
- Inhabited nucleus (Nucleo abitato): small settlements of grouped houses distant from each other no further than 30 meters without public services; they must include at least 15 households and 15 buildings;
- Production plants (Località produttiva): a locality in a non-urban area, with at least 10 firms or 200 employees; it must be large at least 5 hectares.

The remaining territory is delimited, but it doesn't have a specific classification. It represents the extra-urban areas (Case sparse).

The EAs 2021 are drawing on the base of their specific location and topological relations with contiguous. It must be remembered that the topological rules, on the basis of which they are drawing, follow a very precise hierarchy.

In accordance with international standards (see UNITED NATIONS, 2009, and Egenhofer and Franzosa, 1991) the geographical characteristics of the EAs 2021 are listed below:
1) They are closed polygons;
2) They cover all the municipal territory;
3) They are consistent with the administrative hierarchy: Region, Province, Municipality, inhabited .localities.

---

[4] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Land_cover
[5] https://www.eea.europa.eu/help/glossary/eea-glossary/land-use

Let Ω, which is the set of all polygons, that defines the EAs 2021 from the municipality and let $\{S_i, i = 1 \ldots n\}$ the single polygon:

$$s_i \in \Omega \ \text{ for } i=1,\ldots n$$

$$\bigcup_{i=1}^{n} s_i = \Omega \text{ and } \bigcap_{i \neq j} s_{ij} = \varnothing \ \text{ for } i \neq j \tag{1}$$

More generally, indicating the administrative hierarchy with the following symbols:
- R for the region;
- P for the province;
- Ω for the municipality;
- L_h for the locality where with $h = 1, 2, 3, 4$ indicates the different types of localities (inhabited center, inhabited nucleus, productive locality and scattered houses),

then we obtain the following relations:

$$R \supseteq P \supset \Omega \supset L_h \supseteq s_i. \tag{2}$$

The topological properties and the administrative hierarchy, indicated over, are managed using many different GIS tools (Laaribi and Peters, 2019), in accordance with the international standards too (UNITED NATIONS, 2021).

4. First preliminary results and analysis

Table 1 shows the results of the EAs 2021 proposal that Istat sent to all local authorities.

The table is divided by regions and the 14 metropolitan cities (Turin, Milan, Venice, Genoa, Bologna, Florence, Naples, Bari, Reggio Calabria, Catania, Messina, Palermo and Cagliari).

Overall, the number of EAs 2021 are more numerous with respect to those of the 2011 (82.2 percent). Analyzing the absolute values, the number of EAs passes from 402,677 (2011) to 736,265 (2021). These numbers give an idea of the higher quality of the new plot.

North of Italy has the highest percentage variation in terms of the number of the new polygons (103.7 %), followed by South and Isles (77.3 %) and finally the Central Italy (61.5 %).

At regional level, 9 Regions reach an increase in percentage more than 100 percent; while, in the others, the percentage variation is always greater than 50 percent.

The regions, which have the most significant changes in percentage, are: Piedmont (148.7 %), Calabria (140.6 %) and Valle d'Aosta (137.1 %).

Table 1 − *Proposal of the Enumeration areas sent to all Italian municipalities.*

Regions	Municipalities		Enumeration Areas	
	2021	2011	2021	P.C. 11-21
Piedmont	1,180	31,819	79,138	148.7
Valle D'Aosta/ Vallée D'Aoste	74	1,902	4,509	137.1
Lombardy	1,505	47,088	88,801	88.6
Trentino-Alto Adige/Südtirol	282	11,712	24,832	112.0
Veneto	562	30,048	63,632	111.8
Friuli-Venezia Giulia	215	8,278	18,711	126.0
Liguria	233	7,438	14,922	100.6
Emilia-Romagna	327	36,269	55,197	52.2
Tuscany	272	26,729	43,725	63.6
Umbria	92	7,480	12,560	67.9
Marche	227	11,862	20,970	76.8
Lazio	377	18,409	34,485	87.3
Abruzzo	305	9,529	18,585	95.0
Molise	136	2,821	6,645	135.6
Campania	549	20,022	42,834	113.9
Apulia	256	21,013	31,656	50.6
Basilicata	131	5,107	9,755	91.0
Calabria	403	10,818	26,028	140.6
Sicily	387	29,740	48,303	62.4
Sardinia	376	12,650	22,718	79.6
Total	7,889	350,734	668,006	90.5
Large Municipalities	14	51,943	68,259	31.4
North	4,055	155,673	317,051	103.7
Center	1,297	118,927	192,081	61.5
South and Islands	2,550	128,077	227,133	77.3
Italy	7,903	402,677	736,265	82.8

On the other hand, the regions with the lowest 2011-2021 percentage changes are respectively: Apulia (50.6 %), Emilia-Romagna (52.2 %) and Sicily (62.4 %).

Comparing "Microzones" and EAs 2021 (that represent a generalization of the first), we can say that the generalization had a greater impact on the South and Islands (74.2 %) than in Northern Italy (18.5 %).

4.1. EAs 2021, Land Use and Land Cover

By examining some characteristics of the new Istat cartography, one of the most important benefits is the Cod_Tipo_S, a code that identified each polygon on the base of a land cover and use keys (Mugnoli et al., 2018).

As an example, in Table 2 are shown the number for the Tuscany (EAs 2021 divided by singles land cover and use classes.

The graphic representation of the region is shown in Figure 1.

One of the most important innovations is related to infrastructures; in fact, for example, the principal ports and airports visible on the map are linked to specific statistical surveys on infrastructure and for this reason they are called statistical ports and airports.

From a statistical point of view, all the infrastructures are not drawn just as a polygon that define a closed space but following the modern paradigm of 'logistic hub'. In this sense, any pieces of infrastructures are included in a wider territorial context, in which its own task is associated to the transport network. So, they are not only urban elements but a very important part of a connection system of services for the population.

The graphic representation of the region is shown in Figure 1. One of the most important innovations is related to infrastructures; in fact, for example, the principal ports and airports visible on the map are linked to specific statistical surveys on infrastructure and for this reason they are called statistical ports and airports.

From a statistical point of view, all the infrastructures are not drawn just as a polygon that define a closed space, but following the modern paradigm of 'logistic hub'. In this sense, any pieces of infrastructures is included in a wider territorial context, in which its own task is associated to the transport network. So, they are not only urban elements but a very important part of a connection system of services for the population.

Table 2 – *Frequency table of Cod_Tipo_S (Code) in Tuscany.*

Code	Legend	N. EAs	Code	Legend	N. EAs
1	Area or building for residential use	20.271	31	Museum area	68
2	Place of worship (church. convent. mosque)	1.170	32	Technological plant for communication	0
3	Monumental area	115	33	Waste disposal plant	55
4	Monumental square	92	34	Freight village	4
5	Urban park	781	35	Monumental villa	35
6	Port area	68	36	Roads.	1.289
7	Airport area	27	37	Community services	867
8	Military barracks	150	50	Water purification plant	141
9	Hospital	164	53	Recreational purposes	225
10	Rail and railway infrastructure	1.270	55	Shopping center	110
12	Productive activities	2.409	56	Areas of sand	89
15	Cemetery area	1.286	60	Potabilizers	6
16	Sports facility	1.570	61	Cerelas	1
18	Campus	44	62	Temporary grasslands	90
19	Temporary detention center for foreigners	45	63	Fruits trees	23
20	Settlement agglomeration which arose following a calamity	0	64	Olive groves	315
21	Quarry. mining area	455	65	Vineyards	116
22	Woodland	3.630	66	Cropland	36
23	Inland waters and inland and coastal wetlands	1.273	68	Grassland	7
24	Penitentiary institution	16	69	Shrubland	66
25	Hotel. campsites. etc.	204	78	Archeological area	39
26	agricultural area	3.536	79	uncultivated	7
27	Lighthouse	16	80	Salt pans	7
28	Bare Land. lichens and moss	959	81	Greenhouses	0
29	City Hall	274	99	Other	1
30	Plant for the production of electricity	303	100		

Figure 1 – *Map of Tuscany valued for the Cod_Tipo_S.*
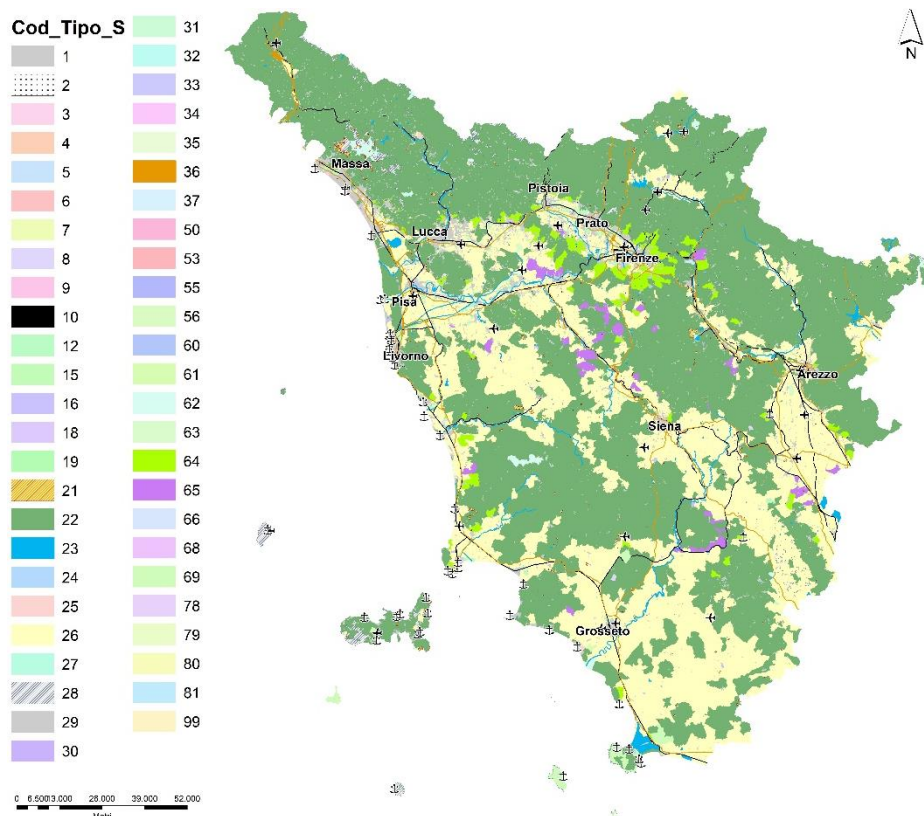
## 5. The growth of the localities and their territorial sustainability

In this context, it is extremely useful to analyze in detail the dynamics of inhabited and productive localities over the last 10 years. Its evaluation identifies how and in which way the urban growth has evolved in Italy (Lipizzi and Mugnoli, 2017). For this purpose, two indicators were calculated starting with their surface and everything using a GIS software tools.

These two indicators are shown below:
- SL: Percentage surface by localities 2021.
- CPSL: Percentage change surface by localities 2011-2021.

In the scatter plot, two perpendicular lines were drawn in correspondence with the "Italy" (see Figure 2). Within the scatter, each region is represented in correspondence of the different quadrants of the Cartesian plane.

Figure 2 – *Map of Tuscany valued for the Cod_Tipo_S.*
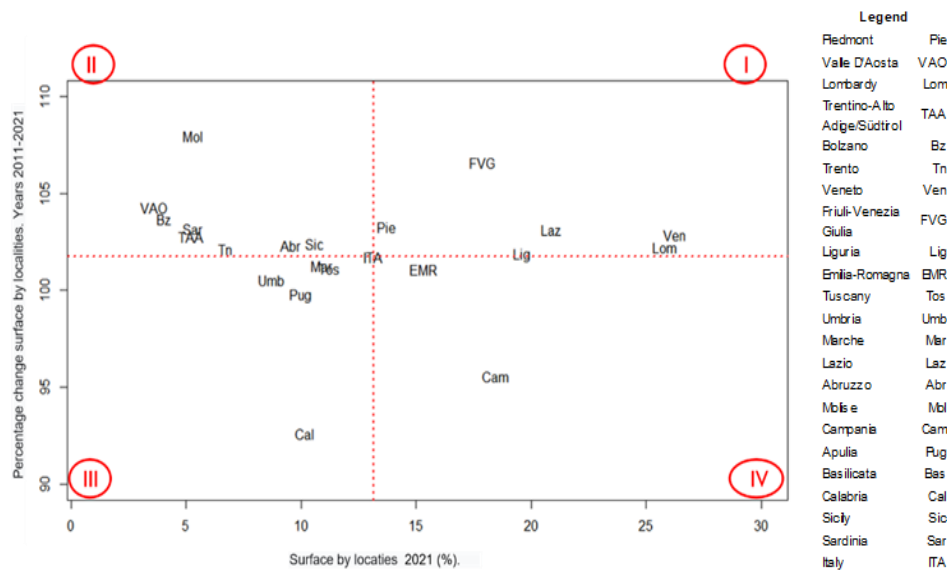
Quadrants first and second are characterized by a growth higher than the National average and, vice versa, in the other two quadrants the growth is lower.

However, the localities do not a uniform growth. Generally, the new ones are smaller than the Italian average, while those already existing are higher than the national values. In the scatter these regions are shown in quadrants second and third and quadrants first and fourth respectively. Primarily tourist localities are characteristic of the first case. Whereas, the localities that grow on the edge of their perimeter are represented in the first and fourth quadrants (see the Figure 2).

The much geared to tourism localities are paradigmatic of the first case; on the other hand, the first and the fourth quadrant collect those localities that grow mainly around their edges and can incorporate nearby inhabited areas.

In the third quadrant, where there are represented Umbria, Puglia, Calabria, etc., the indicators values are lower than the national average; this signifies a stability in the growth compared to 2011. As said above, in the second quadrant there are mainly regions with a strong tourist vocation (Sardinia, Sicily, Valle d'Aosta, Trentino Alto Adige and the autonomous provinces of Trento and Bolzano, etc.).

In the fourth quadrant, the surface per locality is higher than the national one, although the growth is lower than the national percentage variation compared to 2011. The Emilia-Romagna and Campania regions are in this quadrant.

Finally, in the first quadrant are located the regions whose increment is higher than the percentage of the national values. From a spatial point of view these regions are mainly located in Northern Italy: Friuli-Venezia Giulia, Veneto, Lazio, Lombardy, Piedmont and Liguria. It has to be said that this analysis is absolutely provisional, because the population data are not yet available.

6. Conclusion

Starting from 2018, Istat has developed the national geographic layer of the new EAs 2021 layer called "Microzones" which divides the Italian territory in an extremely detailed and homogeneous way. This layer produces a significant increase of information compared to the traditional Enumeration Areas used almost exclusively for the census surveys.

The new EAs 2021 after the validation by local authorities, will be published on the Istat institutional website.

This layer, as highlighted above, will be populated by all census variables. Once the whole process is concluded, the EAs 2021 will become a significant cartographic base to have a detailed description of the Italian territorial situation.

With due caution and appropriate adjustment, another important benefit is the possibility to analyze all the Istat Census cartography from 1991 to 2021; that is, for a period of 30 years. And this is achieved using simple GIS tools.

References

EGENHOFER M. J.. FRANZOSA R. D. 1991. Point-Set Topological Spatial Relations. *International Journal for Geographic Information Systems*. Vol. 5. No. 2, pp. 161-174.

ISTAT. 1992. *Anagrafe della popolazione*. metodi e norme. Serie B – n. 29 edizione 1992. Roma.

LAARIBI A., PETERS L. 2019. *GIS and the 2020 Census: Modernizing Official Statistics.* Redlands. California: Esri Press.

LIPIZZI F. 2013. Innovazioni di processo e di prodotto nelle fasi di aggiornamento delle basi territoriali 2010-2011. *ISTAT Working Papers, 2*.

LIPIZZI F., MUGNOLI S. 2017. Profili e Dinamiche delle Località abitate in Italia. In Istat (eds). *Forme, livelli e dinamiche dell'urbanizzazione in Italia.* Istat, pp. 39-58.

MUGNOLI S., LIPIZZI F. AND ESPOSTO A. 2018. New ISTAT 'microzones' layer: a new way to read land cover statistics. *Journal of Research and Didactics in Geography*, Vol. 2, pp. 95-104.

UNECE. 2021. *Guidelines for Assessing the Quality of Administrative Sources for Use in Censuses.* Geneva*:* United Nations.

UNITED NATIONS. 2009. *Handbook on Geospatial Infrastructure in support of Census activities*. *Studies in Methods*. New York: United Nations.

UNITED NATIONS. 2021. *Handbook on the Management of Population and Housing Censuses*. Series F No. 83. New York: United Nations.

SUMMARY

The Census Maps are an updated photograph of the territorial delimitations adopted (Enumeration areas and Urban localities) which include areas with recently built buildings. The Census Map is the representation of geographical objects that describe the settlement mosaic of the country and its evolution in the medium term, although with some approximation due to the census purposes. This new edition of the 2021 Census Maps will not be used as a basis for the collection of census data that will take place during the year, but rather for the dissemination of the sub-municipal data of 2021. The Enumeration Areas in fact, remain to distinguish exclusively the phase of dissemination of statistical data at the minimum territorial level. This new information layer as highlighted above, will be populated with data relating to the census variables. Once the whole process concluded, Census Maps 2021 will become a significant information asset for a detailed description of the Italian territorial situation.

_____

Fabio LIPIZZI, Istat, lipizzi@istat.it
Alberto SABBI, Istat, sabbi@istat.it
Stefano MUGNOLI, Istat, mugnoli@istat.it
Marina ARCASENZA, Istat, arcasenz@istat.it
Germana ENDENNANI, Istat, endennan@istat.it

ITALIAN INNER AREAS: DEMOGRAPHIC CHARACTERISTICS, EMPLOYMENT AND COMMUTING AND TERRITORIAL DIFFERENTIATIONS[1]

Cira Acampora, Antonella La Faci, Valeriana Leporanico, Massimo Potenzieri,
Matteo Potenzieri

1. Introduction

Most of the Italian territory is characterized by the aggregation of citizens in smaller centers, even very small ones, located in inland areas. Starting from this assumption and from the variety and specificity of the same, the need was felt to study and interpret the interaction between urban and metropolitan territories and these areas through the comparison of specific socio-demographic and economic indicators (Dip. politiche di coesione. 2022. *Criteri per la Selezione delle Aree Interne da sostenere nel ciclo 2021 – 2027)*, aimed at highlighting which are the main determinants of marginality of these territories. The policy for Inner Areas originated in 2013 and has its roots in the more general strategy for "territorial cohesion based on places", which draws direct foundation and legitimacy from the Treaty on the Functioning of the European Union, in particular, art. 174. As regards Italy, the Partnership Agreement 2014-2020 defines the approach aimed at addressing the demographic challenges of the regions and tends to respond to the specific needs of geographical areas characterized by serious and permanent natural and demographic handicaps (De Rossi, 2019). That's the context in which the general definition of "Inner Areas" is presented, and means that most part of the Italian territory characterized by the significant distance from the centers of supply of essential services identified in education, in health and mobility; in particular, such services shall mean: 1) a complete upper secondary education offer (i.e., at least a high school, a technical school and a vocational school); 2) a hospital of DEA (Department of Emergency and Acceptance I level); 3) a railway station at least of the silver type (medium/small plants, with a frequency generally greater than 2,500 average users/day) and services for the long, medium and short distance or - in the case of urban subway - medium/small stations and stops, with consistent attendance (even greater than 4,000 average users/day). However, these areas normally have important environmental resources (agricultural systems, forests,

---

[1] Authors of the sections: 1. Matteo Potenzieri; 1.1 Matteo Potenzieri e Valeriana Leporanico;
2. Valeriana Leporanico e Massimo Potenzieri; 2.1 Cira Acampora; 3. Valeriana Leporanico;
4. Antonella La Faci, 5. Massimo Potenzieri; 6 Massimo Potenzieri; 7. Valeriana Leporanico.

natural and human landscapes, water resources, etc …) and cultural assets (archaeological heritage, historic settlements, abbeys, small museums, craft centres, etc …); they are however deeply diversified territories, outcome of the dynamics of the various natural systems and the peculiar processes of settlement. Referring to their first perimeter, these areas represented about 60% of the territory and 21.5% of the population. (Barca et al., 2014). In 2022, however, Istat (Italian National Institute of Statistical) updated from 2013 to 2020 the national geography of the Inner Areas, reclassifying all 7,903 Italian municipalities according to the levels of accessibility to the nearest "Service Offering Centre". The adopted methodology identifies the nature of the Inner Area of a municipality based upon the distance, expressed in terms of minutes of road travel, to the nearest service offering centre. In this way it was possible to classify the municipalities according to the degree of peripherally and group them into 6 types: Pole, Inter-municipal Pole, Belt, Intermediate Areas, Peripheral Areas and Ultra-peripheral Areas. The municipalities that are comprised into the last 3 classes constitute the whole of the Italian Inner Areas, while the municipalities of the first two represent the service offering centres. It was also carried out a mapping on the territory of the structures related to the three services mentioned above and the comparison with the services present in the 2013 edition has brought out a lower spread of services on the territory, regarding the decrease in hospitals with level I or level II DEA. This dynamic has generated a net contraction of the number of the Poles and the intercommunal Poles, resulting in a reduction of the number of centres of offer of services. Specifically, in the comparison 2013-2020 (Table 1), it goes from 217 Poles and 122 intercommunal Poles (in total 339), to 179 and 85 (in total 264), with a loss of 75 centers overall. It should be considered that, within the "Polo" Municipalities there are all three services considered while the Municipalities defined as "Intercommunal Pole" are a set of neighboring municipalities where, as a whole, there are all three services considered. The innovations introduced, which have substantially refined the ability of classification of the Municipalities with respect to the supply centres, have determined an increase in their degree of peripherally, as a result of the combination of the reduction in the number of poles and the increase in average journey times. The expected overall geography has therefore been characterized by a significant increase in the extension of the Inner Areas, both in the number of municipalities and the resident population involved. From the comparison 2014-2020 emerges the contraction of the municipalities classified in Pole, Pole Intercommunal and Intermediate, and a consequent increase of those identified in Belt, Peripheral and Ultra peripheral. In particular, the number of intercommunal Poles is reduced by more than 50% (from 122 Municipalities in 2014 to 59 in 2020), with the effect of a decrease in the total resident population in the Poles and inter-municipal Poles that goes from about

24.3 million in 2014 to 22 million in 2020. The decrease is clear (-16%) also in the number of intermediate municipalities, which go from 2,288 to 1,928. By contrast, they increased by 9.1%, the Municipalities of belt (from 3,509 to 3,828) and the peripheral and ultra-peripheral municipalities of 7.9% (from 1,767 to 1,906).

Table 1 – *Population in 2020 and distribution of municipalities in SNAI areas in 2014 and 2020.*

Regional groups	Number of municipatlities			
	2014	2020	Absolute change	Change %
Urban Poles	217	182	-35	-16.1
Inter-municipal Poles	122	59	-63	-51.6
Belt	3,509	3,828	319	9.1
Intermediate	2,288	1,928	-360	-15.7
Peripheral	1,475	1,524	49	3.3
Ultra-peripheral	292	382	90	30.8
Regional groups	Population			
	2014	2020	Absolute change	Change %
Urban Poles	21,271,729	20,470,301	-801,428	-3.8
Inter-municipal Poles	2,992,749	1,576,586	-1,416,163	-47.3
Belt	22,248,629	23,756,465	1,507,836	6.8
Intermediate	8,495,430	8,059,454	-435,976	-5.1
Peripheral	3,585,164	4,653,355	1,068,191	29.8
Ultra-peripheral	642,512	720,052	77,540	12.1

Source: Our data processing from Istat.

1.1 The distance matrix and relevant thresholds

As regards the methodologies for calculating road journey times, an impedance factor was then used with the aim of taking into account the effective capacity of the communication routes, considering also the presence of possible slowdown factors due to the vehicular traffic, the presence of traffic lights, etc…, and thus providing results that are more in line with reality. The distribution of travel times so calculated for all Italian municipalities was on average higher than the previous edition, initiating also a more precise reflection on the possible necessity to revise the thresholds of distance used in order to classify the Municipalities in the three typologies of Inner Areas. After identifying the Service Offer Centers, the matrix of the distances between each Municipality and the nearest gravitation pole was constructed with a calculation methodology for the threshold values similar to that of 2014 (distances calculated considering the ordering of the Municipalities in based on the increasing value of the distance of each one from the nearest pole and considering the values at the median, the third quartile and the 95th percentile) (Table 2). The elaborations were carried out using the ArcGIS software. For the update of the IA 2020 Map, Istat has calculated the average travel times from a municipality to the centroid of the municipal or inter-municipal pole (identified using the census section that contains the Municipality of the Municipality)

considering the movements detected in the week that goes from 14 to 20 October 2019 in the three time slots 7.30, 8.30, 9.30 of all working days, in which the majority of the population travels for work or study. For each municipality, the travel time considered is given by the average value of the travel times in the three-time bands indicated in the five working days considered. In the methodologies for calculating road travel times, an impedance factor was used with the aim of taking into account the effective capacity of the communication routes, also considering the presence of possible slowdown reasons due to vehicular traffic, in the presence of traffic lights, etc. and therefore providing results that are closer to reality. The distribution of travel times thus calculated for all Italian municipalities was on average higher than in the 2013 edition, also initiating a reflection on the possible need to review the distance thresholds used to classify the Municipalities in the three types of Areas Internal (NUVAP Technical Note, 2022).

Table 2 – *Comparison of 2014 and 2020 map threshold values based on distance distribution in minutes.*

Threshold	Map IA 2014	Map IA 2020
Median	20	27.7
3°quartile	40	40.9
95°percentile	75	66.9

Source: Our data processing from Istat.

As is evident from table 2, while applying the same calculation technique as in 2014, the values for the median change (meaning the distance threshold within which a Municipality belongs to the belt belt), goes from 20 to 27.7 minutes; the threshold value that identifies the beginning of the peripheral belt slightly increases from 40 to 40.9 minutes; while the most extreme reference value decreases from 75 to 66.9 minutes.

2. Population dynamics

Between 1951 and 2020 the population decreases in the Inner Areas and increases in the Centers. In particular, the Inner Areas in Italy have lost 1.3 million residents, with an absolute variation of – 8.8% since 1951; the South and Islands, in the same period, has lost 855 thousand inhabitants with a variation of -10.6%.

In absolute values, in the Centers, the distribution with a greater increase in population is the north which gains 6.7 million inhabitants. In percentage terms, the Centre earns 53% compared to 1951 and the North 38.8% (Figure 1).

Figure 1 – *Population dynamics from 1951 to 2020 by area (millions of people).*
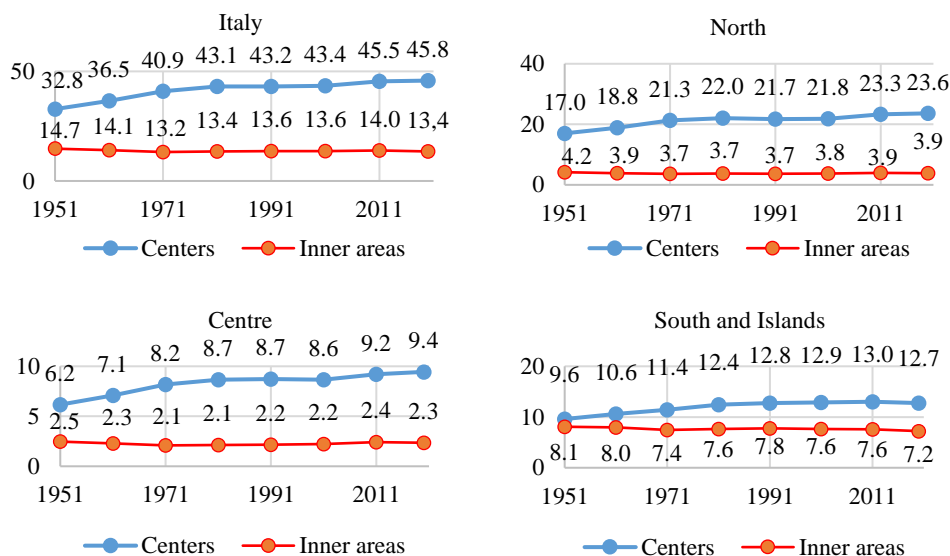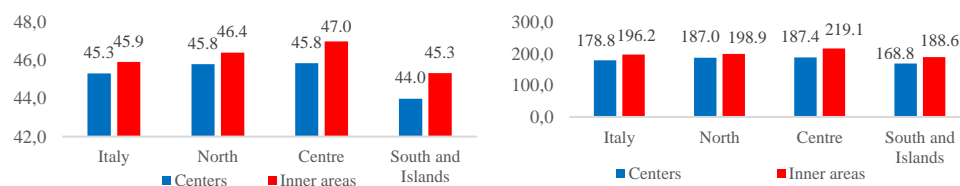

Source: Our data processing from Istat Permanent population census, year 2020

2.1. Population Structure: Demographic Indicators

Socio-demographic indicators highlight particular differences between Centers and Inner Areas. In the South, and Islands Italy, for middle age there is a difference between Centers and Inner Areas of over 1 year, while in the North it is less than one year as for the national average and, in the Centre, it is little more than one year. The municipalities on average younger are those of the inter-municipal Center and Belt of the South and Islands (43 years), the least young are instead in the outermost municipalities and in the peripheral areas of the Centre with an average age of 49 and 48 years (Figure 2).

Figure 2 – *Middle age and old age index.*

Source: Our data processing from Istat Permanent population census, year 2020

In the North, the difference between Inner Areas and Centers is less marked, while it is particularly evident in the Centre, where in the Inner Areas there are 216 over-

65s every 100 under-15s, while there are 199 in the North, 189 in the South and Islands, compared with the national average value of 196. In the outermost Areas, the ratio rises to 266 for the Centre, 239 for the South and Islands and 223 for Italy.

3. Education

Only in the North, the percentage of residents aged 9 and over who have obtained the high school is higher in the Inner Areas than in the Centers (37.6% against 37.3%) while, both nationally and in the regions of Centre, South and Islands, although a few percentage points is the reverse (Figure 3). The share of residents with degree is increasingly higher in the Centers than in the Inner Areas and is higher than the national average in the Inner Areas of the Centre, South and Islands regions (respectively 12.6% and 11.8% against 11.6%).

Figure 3 – *Population aged 9 and over by level of education.*
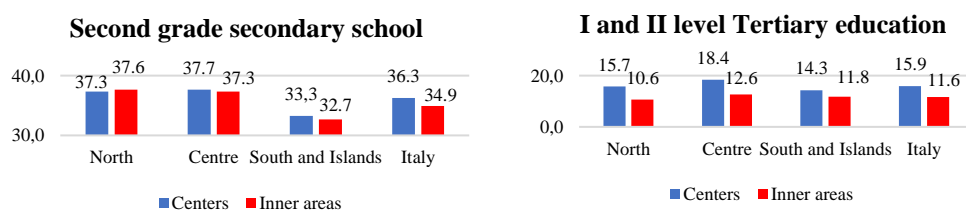
Source: Our data processing from Istat Permanent population census, year 2019.

4. Commuting

4.1. Commuting within and outside

In 2019, every day 30,214,401 people move within the municipality of residence or in other municipalities (50.7% of the resident population): of these, 49.9% reside in the North, 20.4% in the Centre and 29.7% in the South and Islands.

The displacements are greater in the Centers (Italy 79.1 %) and inside of the just municipality of residence (46.1%) (Table 3).

4.2. Commuting for working and study

Going into the details of the motivations that drive such movements, those who travel for work (20,517,799) or for study (9,696,602) come from the Centers and reside in Northern Italy (13.9%). Although the greatest number of commuting students resides in the regions of Centre Italy (16.4%), this is also to the difference in the unemployment rate and the age of the resident population (Table 4).

Table 4 – *Resident population, daily travel for study and work. Year 2019, percentage values.*

Territorial bands	Commuting for working				Commuting for studying			
	Italy	South and Islands	Centre	North	Italy	South and Islands	Centre	North
Centers	27.3	18.0	28.8	33.4	12.8	11.0	13.4	13.9
Inner Areas	7.1	9.9	6.9	5.2	3.4	5.5	3.0	2.1
Total	34.4	27.9	35.7	38.6	16.2	15.5	16.4	16.0

Source: Our data processing from Istat Permanent population census, year 2019.

5. Labor market

Italy has always been characterized by a low level of employment and a high presence of people searching work, albeit in a less active way, especially when compared to other European countries (Istat, Il Mercato del lavoro 2020).

Figure 4 – *Activity rate and employment rate, in Centers and Inner Areas.*
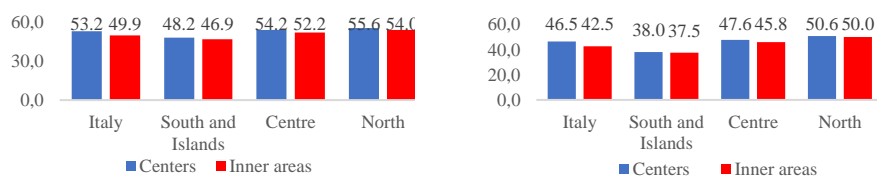
Source: Our data processing from Istat Permanent population census, year 2020.

In reference to the General Census of population and housing in 2019, out of 100 people aged 15 and over living in Italy, only 46.5, among habitual residence in the Centers, are occupied; in the Inner Areas the value is reduced to 42.5 with a difference of 4 percentage points. In the common Belt the rate rises to 47.2% (+6 points compared to the common Peripherals and Ultra peripherals). In the North breakdown, the highest value is recorded in the Outermost Area (51.8%). To confirm this, labour market participation, measured by the rate of activity resulting from the ratio of persons in the labour force to the corresponding reference population, is also higher in the Centers than in the Inner Areas, with a difference in Italy of 3.3 percentage points (53.2% against 49.9%), and in the South and Islands of almost 2 percentage points (48.2% against 46.9%). The highest activity rate is recorded in the Northern Belt area (56.1%) followed by the Outermost area of the same breakdown (55.2%); the lowest is reported in the Outermost area of the South and Islands (46.4%) (Figure 4). As for the unemployment rate, always in 2019, in Italy it is higher in the Inner areas than in the centers with a difference of about 2% (14.8% against 12.7%), in reverse in the South and in the North is higher

in the centers than in the Inner areas (1% for the South and Islands, 1.2% for the North). The rate of youth unemployment, given by the ratio of job seekers aged 15 to 24 and the labour force in the same age group, is higher in the Centers than in the Inner Regions, in all territorial divisions. Considerable differences between the different parts of the Country, both in the Inner Areas and in the Centers: the youth unemployment rate is higher in the Inner Areas of the South than in the North by 27 percentage points, in the Centers the gap exceeds 26 percentage points.

6. The production system

The average size of the local units present in the Inner areas is equal to three employees against the four of the Centers, with a general tendency to decrease as you move from the North to the South; on the other hand, the difference between the average size of the Centers and the Inner Areas is growing, moving towards the South; this attests a greater structural fragility of the production system of the Inner Areas of the southern regions as regards the northern ones. In Italy about 80% of the local units of active enterprises are located in the Centers, involving 83% of total employees. In the South and Islands, 65% of the local units are in the Centers and employ over 68% of the workers, while in the Centers of the North 87.2% of the local units are concentrated with more than 88% of the employees (Figure 5). A first element of interest that comes out from the productivity analysis of the enterprises expressed in terms of added value for employee, depends on the fact that such value decreases considerably moving towards the Inner Areas. For this purpose, for to the particularity of the topic, it is intended to broaden and deepen the concept of Internal Areas to provide as complete a picture of the context as possible.

Figure 5 – *Local units and employees per macro regions and SNAI Areas- year 2019.*
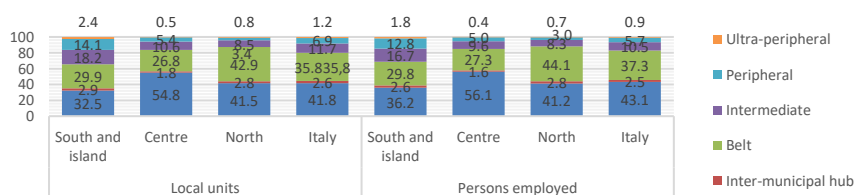
Source: Our data processing from Istat.

Between the Poles and the Ultra-peripheral areas, the largest gap is recorded in Central Italy (18,778 €), the smallest in the North (10,632 €). Compared to the average Italy of 48 thousand 868 euros, in the South and Islands the added value is significantly lower, both in the Centers (-11 thousand euro) and in the Inner Areas

(- 17 thousand euro). At the national level, average wages are also significantly lower in the Inner Areas than in the Centers. In the Inner areas of Southern Italy, the wages are lower on average, compared to the Italian one of € 6,500. Even for the salaries per employee, the smaller gap between the Pole and the outermost area is recorded in the North (3,161€ against 4,825 € of the average Italy) (Table 5).

Table 5 – *Value added and compensation per employee and distribution in SNAI areas - Year 2019 (values in thousands).*

Territorial bands	Italy		South and islands			Centre		North
	Added value by employee	Salary by employee	Added value by employee	Salary by employee	Added value by employee	Salary by employee	Added value by employee	Salary by employee
Urban Poles	52,491	26,901	40,970	22,423	51,781	26,093	56,983	28,844
Inter-municipal Poles	43,537	24,976	31,432	19,059	40,856	23,187	48,862	27,318
Belt	49,005	27,141	34,113	20,794	49,031	25,72	53,114	29,065
Intermediate	42,145	24,406	31,456	19,674	40,357	24,127	51,755	28,078
Peripheral	37,239	22,835	31,966	20,55	37,327	23,429	46,359	26,296
Ultra-peripheral	35,864	22,076	26,656	18,153	33,003	21,818	46,351	25,683

Source: Our data processing from Istat

7. Analysis of Inner Areas profiles

The analyzed indicators are both demographic and economic and have been compared between Centers and Inner Areas. Finally, this information was summarized through factorial and logistical analysis (Fabris L., 1997). All indicators have been adopted and principal component analysis (PCA) has been applied a statistical technique for the reduction of the size and has the aim to reduce the more or less large number of variables that describe a set of data to a smaller number of latent variables, limiting, however, as much as possible, the loss of information. The number of indicators has increased from 14 to 3: demographic indicators, work and commuting, and economic indicators. The coefficients of the three factors, elaborated in SAS, are given in the following table, contains the rotated factor loadings, which are the correlations between the variable and the factor. In particular: the first factor is related to variables related to demographic indicators and more weakly to others; the second factor is related to both indicators related to commuting (strongly influenced by the values of X9 and X7) both with the remaining variables such as labour market indicators, where it is strongly influenced by the employment rate, directly while, inversely, by the unemployment

and youth unemployment rate; finally, the third factor is exclusively related to the productivity and profitability indicators. Although the three factors are all significant, the first and second factors have a higher explained variance than the third, in particular, the first factor related to demographic structure has a greater weight in the synthesis of population characteristics (4.41) (Table 6).

Table 6 – *Rotated Factor Pattern.*

Indicators		Factor1		Factor2		Factor3	
x1	Middle age	**97**	*	-4		-11	*
x2	Old age index	**89**	*	-11	*	-11	*
x3	Dependency index	**87**	*	-6		-1	
x4	Index of Elderly Dependency	**96**	*	-10		-7	
x5	Index of Active Population Structure	**68**	*	41	*	-5	
x6	Commuting out of the ordinary	10	*	**63**	*	-14	*
x7	Total commuting	-55	*	**73**	*	31	*
x8	Commuting for work	-86	*	**16**	*	14	*
x9	Commuting for study	-31	*	**85**	*	33	*
x10	Employment rate	-29	*	**86**	*	32	*
x11	Unemployment rate	-12	*	**-89**	*	-28	*
x12	Youth unemployment rate	-3		**-80**	*	-25	*
x13	Value added per employee	-11	*	18	*	**89**	*
x14	Compensation per employee	-13	*	34	*	**83**	*
Variance Explained by Each Factor		**4.41**		**4.18**		**2.00**	

Source: Our data processing from Istat
Notes: The printed values are multiplied by 100 and rounded to the nearest integer. Values greater than 0.1 are marked with a '*'.

Subsequently, these three factors have been inserted in a logistic model, whose dependent variable is a dichotomy that assumes value 1 in the cases in which the municipality belongs to an Inner Area and 0 in the case in which it belongs to a Centre and, all factors constitute the independent variables. In order, to analyze the association between two variables, the method of the Maximum similarity and the odds ratio has been used. In the first table it is seen that these three factors turn out meaningful, in particular, the first factor has a positive correlation with the dichotomous variable (to be in Inner area), the other two factors point out a negative correlation and therefore a negative weight in the municipalities classified as Inner Areas, confirming that low values of productivity and profitability are typical of the Inner ones. The *odds ratio* represents instead, the probability that the event happens with the variation of the independent variable and if it is greater than 1 tell us that there is an increasing relationship between the two variables, values less than 1 show the opposite and this is evidently a different key to the model (Table 7).

Table 7 – *Analysis of Maximum Likelihood Estimates and Odds Ratio Estimates.*

Parameter	Estimate	Pr>ChiQ	Pr>ChiSq	ChiSq	Effect	Point Estimate	95% Wald Confidence Limits	
Factor1	0.6562	0.0295	<0.0001	0.3618	Factor1	1.927	1.819	2.042
Factor2	-0.7161	0.0272	<0.0001	-0.3948	Factor2	0.489	0.463	0.515
Factor3	-0.3745	0.0263	<0.0001	-0.2065	Factor3	0.688	0.653	0.724

Source: Our data processing from Istat.

8. Conclusions

The review of the Map of the Internal Areas updated to 2020 on which the study was based, confirms the high risk of marginalization of the internal territories from an economic and socio-demographic point of view. However, the renewed attention of the political decision-maker combined with the PNRR resources available, in the presence of incontrovertible data and a clear *mission* to be addressed (the adjustment in quality and quantity of services relating to work, school and mobility, with the promotion of suitable development projects that can best enhance the cultural and natural heritage of these areas, and the reversal of current demographic trends), makes us think (and hope) that the one illustrated can only be the first chapter of a series of data that over time certify the progressive, lower marginality of the internal areas of our country.

Appendix

Middle age: it is calculated as a weighted average with weights equal to the amount of the population in each age group.

Old age index: it is the ratio between the population aged 65 and over and the population aged 0-14, multiplied by 100.

Tertiary and higher education: includes tertiary education (I and II level) PhD and academic research training diploma.

Acknowledgements

References

BARCA F., CASAVOLA P., LUCATELLI S. 2014. *A Strategy for Inner Areas in Italy: Definition, Objectives, Tools and Governance,* Materiali Uval Issue n. 31.

DE ROSSI, A. 2019. *Riabitare l'Italia: le aree interne tra abbandoni e riconquiste*. Roma: Donzelli editore.

Dipartimento per le politiche di coesione.2022. *Aggiornamento 2020 della mappa delle aree interne. Nota tecnica NUVAP*.

Dipartimento per le politiche di coesione. 2022. *Criteri per la Selezione delle Aree Interne da sostenere nel ciclo 2021 – 2027*.

FABRIS L. 1997. *Statistica multivariata. Analisi esplorativa dei dati*. New York: McGraw-Hill Companies.

Istat, Il Mercato del lavoro 2020. *https://www.istat.it/it/archivio/254007*

SUMMARY

The municipalities geographically located in hilly Inner or mountainous areas and quite significantly distant from essential services (collective mobility, health, high-level education, etc.) on the basis of an accessibility indicator calculated in terms of minutes of travel compared to the nearest Pole (centre of offer of services), are identified as Inner Areas (A.I.) by ISTAT. These municipalities, which are characterised by considerable environmental and cultural resources, generally point out issues in employment, demographic ageing, depopulation and commuting. The proposed study aims to outline the profiles of the Inner Areas in terms of socio-economic and economic indicators and highlights which are the main determinants of marginality of these territories.

_____

Cira ACAMPORA, Istat, acampora@istat.it
Antonella LA FACI, Istat, lafaci@istat.it
Valeriana LEPORANICO, Istat, valeriana.leporanico@istat.it
Massimo POTENZIERI, Istat, mapotenz@istat.it
Matteo POTENZIERI, Istat, potenzie@istat.it

ISSUES AND SOLUTIONS USING OPEN STREET MAP: THE CASE OF SECONDARY ROADS IN SICILY[1]

Riccardo Abbate, Alberto Dolce, Rosario Milazzo, Antonio Pannico

1. The strategic role of road transport in Sicily

To date, the equipment and functionalities of the sustainable mobility services available in the Inner Areas are not such as to represent an alternative to the use of the car. This not only in relation to traditional rail transport services, but also to innovative services related to sharing mobility, micro-mobility, infomobility, flexible public transport services.

The entire offer of services tends to be concentrated in large urban areas and this makes transport in Inner Areas unsustainable also in terms of cost, because there is no alternative to using the car, as well as in terms of environmental and social sustainability. This is confirmed by the railway network endowment index, equal to 59.89 (Italy = 100; Southern Italy = 87.91), which recorded a worsening, both in absolute terms (in 2001 the index was equal to 64), and in relation only to the regions of the South, as a consequence of the disposals in 2002 and of the new railway investments in the southern peninsula.

Hence the strategic role of road transport in the short-medium term of road transport in the development strategies of inland areas. This determines the absence of a valid alternative to the road transport system, which can have limited access to the financing of community resources and, above all, as regards the secondary roads, with the consequent need to carry out extraordinary maintenance interventions on this Program. and redevelopment of the existing road network which can guarantee - in the first place - the safety of users of the road infrastructure.

The development objectives of the Sicilian Road System have as reference elements the Integrated Plan of Infrastructures and Mobility of the Sicilian Region, the APQ "Road transport" and the strategy promoted by the European Union with the 2011 White Paper "Roadmap towards a single European transport area - for a

---

[1] Par. 1 Alberto Dolce and Antonio Pannico, Par. 2 Rosario Milazzo, Par. 3 e 4 , Riccardo Abbate, Par. 5 Alberto Dolce

competitive and sustainable transport policy", aimed at combining the increase in mobility with the improvement of road safety and the reduction of emissions.

Not only is it essential to redevelop, by increasing the regional road network, both belonging to the primary level, of connection of the main nodes, and to the secondary level, of penetration and access to territories, but it is also fundamental to adopt a management growth path, on the part of road owners, which aims to overcome the logic of emergency management of road maintenance and which constitutes solid knowledge bases for the implementation, in network logic, of scheduled maintenance techniques. These knowledge bases, relating not only to the consistency but mainly to the condition of the state of the Sicilian road network, are in fact the starting point for the optimization of maintenance interventions to be implemented over time so that, by hierarchizing the intervention priorities and in the compliance with investment constraints, the best result can be guaranteed in terms of investment effectiveness and the state of the road network. Maintenance must therefore represent both the improvement and management of existing networks, and through the constitution of specific investment plans for the lesser way, a necessary road objective, an objective that must not be neglected, both for positive needs. in terms of employment and in terms of development of the functions of the establishments (tourism, hospitality, environmental, protection, etc.) and of response to demographic changes and territorial challenges acquired over time. For this type of enhancement of road infrastructures, from the point of view of functionality and safety, coordinated with respect for environmental resources and the socio-economic development of the territorial area of insertion, it is essential to identify an ordering of roads based on both the use and they are associated in the territory and on their role within the road network framework to which they belong to.

The New Italian Highway Code (Legislative decree 30 April 1992, n. 285) with article 13, paragraph 6 establishes the Cadastre of roads or road cadastre. In particular, the article in question reads:

The road owners are obliged to establish and keep up to date the cartography, the cadastre of the roads and their appurtenances according to the procedures established with a specific decree that the Minister of Infrastructure and Transport issues after consultation with the Higher Council for Public Works and the National Council. of searches. The land registry must also include permanent installations and services connected to the needs of road traffic.

The rule that establishes the characteristics of the Road Cadastre arrived in 2001: "Procedures for establishing and updating the Road Cadastre pursuant to art. 13, paragraph 6, of Legislative Decree 30 April 1992, n. 285, and subsequent amendments - D.M. LL. PP. 1 June 2001 (Ministero dei Lavori Pubblici)" and is

based on the European standard GDF - Geographic Data File - Roads and Railways section.

The provision and implementation of the Road Cadastre for the competent authorities is not only a legislative obligation but represents an important opportunity to have a precise knowledge of the infrastructure that is in custody in order to be able, thus, to prepare an efficient planning of each activity of conservation and maintenance having knowledge not only of the kilometric dimensions, but of every other element that insists on the path of its competence.

The moment of recognition of the state of affairs, aimed at identifying the technical characteristics of the road, must be preceded for the purposes of classification by an overall potential assessment of the network, which leads to the definition based on the role, and type of traffic served, the relationship functional hierarchy between the individual roads (objective function).

For this reason, it is inadequate to act with limited initiatives, but it is necessary, instead, to articulate a set of actions that, in addition to addressing specific problems, help to raise the overall level of mobility governance.

Raising the quality of road design is one of these actions because, in addition to increasing the average standard of interventions, it increases the ability of the public client to express a culture of action capable of harmonizing the evolution of techniques and technologies with the need for sustainable development of the territory and the communities that inhabit it.

For this purpose, the D.M. 5/11/2001 "Functional and geometric standards for road design", indicates the fundamental factors which, characterizing the road networks from a functional point of view, make it possible to place the network under study in a specific class. They are:

Type of movement served (transit, distribution, penetration, access); the movement is also to be understood in the opposite sense, that is, of progressive collection at the various levels:

• Extent of displacement (average distance travelled and vehicular flow);

• Function assumed in the territorial context crossed (national, interregional, provincial, local link);

• Traffic components and related categories (light vehicles, heavy vehicles, motorcycles, pedestrians, etc.).

Strengthening the administrative and support capacity of local authorities in the planning, management, implementation and reporting of interventions based on available extra-regional resources, is a discriminating element with respect to the success of the entire regional programming, given the financial resources allocated to Sicilian local authorities.

The Sicilian Region, with DGR n. 426/2018, established the Special Office for regional planning to give a concrete response to the needs of municipalities,

metropolitan cities and free municipal consortia, often lacking in internal technical skills, allowing them to make use of the technical skills and know-how of regional administration. With the DD n. 1/2019 of the Manager of the Office in question, the model agreement scheme between the Special Design Office and local authorities was approved; with DA n.16 / 2019, the Regional Councillor for Infrastructure and Mobility finally defined its functioning.

2. The information sources of the national road network: subjects, rules and classifications

Data on road infrastructures (motorways, roads of national interest, regional and provincial roads and municipal roads) are characterized by a fragmentation of competences entrusted, by the legislation currently under review, to various national and territorial bodies based on the classification of the roads. Specifically, the main subjects that collect and manage information on road infrastructures are:
    • Anas, which is responsible for directly managed motorways, motorway junctions and part of the state roads;
    • Aiscat, which manages the motorways not managed by Anas and the tunnels;
    • Regions and Provinces that have jurisdiction on state roads not managed by Anas and on regional and provincial roads;
    • Municipalities that manage municipal roads.
The Ministry of Infrastructure and Transport collects from these Subjects the information that is published annually in the "National infrastructure and transport account – 2019" (Minister Infrastructure and Trasport, 2019) with a regional detail for motorways, roads of national interest, regional and provincial roads, and in the case of municipal roads through a survey conducted in the provincial capitals.
The legislation on the division and legal attribution of many of the main Italian roads between state roads (now called "of national interest", together with the motorways), regional, provincial and municipal roads is under review[2]. This is the consequence of the legal / administrative structure, established by Legislative Decree 31 March 1998, n. 112, which involved the national road network. The aforementioned Legislative Decree of "Conferral of functions and administrative tasks of the State to the Regions and Local Authorities, in implementation of chapter I of the law of 15 March 1997, n. 59", has in fact fixed the transfer of roads

---

[2]   Proposal for the revision of the national road network Government Act 91 – 92. In the National Infrastructure and Transport Account - Years 2019-2020 is underlined that "the division and legal attribution of many of the main Italian roads between the former state roads (now called "of national interest", together with the Motorways), Regional, Provincial and Municipal ".

and motorways, formerly belonging to the state property, to the state property of the Regions or, with regional laws, to the property of the local authorities. In the context of this assignment, the related administrative functions not expressly attributed to the State are also transferred to the Regions and Local Authorities.

The passage to the Regions of roads not included in the national motorway and road network "" took place in the total absence of a basic governance model ". In fact, the "devolution" of the road network was not accompanied by clear strategic choices and adequate financial resources, which could put local authorities in a position to manage the new functions adequately, thus inducing a differentiation of management models as the boundaries vary territorial. The consequences of these criticalities have also led to the inhomogeneity of the information processes including those relating to the monitoring of the extension of the road network with a sub-provincial level of territorial detail. These criticalities therefore triggered a process of rethinking the attribution of a part of the road network to local authorities.

The classification of the road network published by MIT in the «National infrastructure and transport account» represents a macro summary of the more precise classification governed by art. 2, paragraph 2, of Legislative Decree 295/1992 (Highway Code), which sees the roads classified, with regard to their constructive, technical and functional characteristics, in the following types:

a) Highways;
b) Main extra-urban roads;
c) Secondary suburban roads;
d) Urban sliding roads;
e) Urban neighbourhood streets;
f) Local roads;
g) F-bis - Cycle and pedestrian routes.

This classification detail is not present in any type of territorial and geographical information system except for Open Street Map (OSM), which therefore represents the only tool that potentially, with the necessary corrections, can provide information on the national road network with a sub-provincial level of detail, filling that information / knowledge gap of a fundamental and strategic area for the planning of new territorial development policies.

3. Methods and tools to offer a reliable measure of the road endowment of a geographical area

The need to upgrade the regional road network both at primary level (through the connection of main nodes) and at secondary level (through penetration and

access to territories) can be achieved by increasing safety and sustainability. This is a key step for road owners to begin a management growth path aiming to overcome the logic of emergency management for road maintenance and building a solid knowledge base for implementing, scheduled maintenance techniques according to a network logic.The use of GIS (Geographic Information Systems) tools and open-source databases of roads, such as *Open Street Map* (OSM), can help to adequately understand the type and correct length of roads to be implemented in a territory (ISTAT, 2019). The carriageway length in meters per direction of travel of the road (in the Open Street Map) definitely provides a first coherent series of information relating to the various territories. This information is not available in national official statistics and, though territorially detailed road maps and archives exist, the harmonized and systematic national official road cadastre is far from being complete despite having been created in April 1992 by legislative decree 285 and amended in June 2001. The integration of OSM data (Open Street Map, 2022) with the information layers of the inhabited localities in the ISTAT territorial bases (ISTAT, 2016) further allows to obtain correct information relating to the identification of the road sections on a territory, especially for the secondary road network in Sicily.

Such identification allows improving road infrastructures in terms of functionality, safety and environmental resources, takes into account the socio-economic development of the local area of insertion and is a key element in identifying an ordering road based on both their use in the territory and their role within the road network they belong to.

Planning road maintenance activities in the network without identifying the real kilometre length would be like restoring a building without knowing its size.

Therefore, monitoring requires identifying the actual road heritage, especially for municipal roads, i.e., the extension in km of the roads within the municipal boundaries.

There are different information and regulatory areas the must be jointly taken into account to understand how to identify the streets according to different classification systems: Open Street Map has its own classification system that obviously does not coincide with that of the Italian Highway Code (which is a national system, not international). OSM provides an extremely detailed classification and does not define the roads according to their use or the area they are in, or even according to the legal attribution for the management of the road network. Here's an example In Sicily: road passing through an inhabited centre is considered as a state road (SS), therefore it is subject to state management, but only if the municipality has less than 10,000 residents, otherwise road management will be at municipal level, as it is considered a urban road. Conversely, it may happen that a road of particular importance (e.g., a beltway), while passing through an

inhabited area of a large Sicilian city, is exclusively under state jurisdiction. Since the allocation of funds for management and maintenance of the road network is often linked to the managing body, using two different classification systems for road identification could lead to inaccurate results for determining the amount of km of roads by type, falling within the municipal area.

In any case, the Open Street Map makes it possible to trace a correct classification of the streets, with the necessary *interventions*, filling that information / knowledge gap of an area, which is fundamental and strategic for the planning of new territorial development policies.

OSM today has more than four million users worldwide, is supported by Open Street Map Foundation, and contributes to providing data, individual members, commercial companies, associations, governmental and non-governmental entities. The open-source geodatabase collects vector data of areas and territories, point layers of places, land use layers, point and polygonal data of infrastructures, and road graphs.

The classification includes five groups of road categories: *main roads, minor roads, motorway connections (stopovers / ramps), very small roads, routes not suitable for cars* (Open Street Map, 2021). Within each group we find different road categories and each category corresponds to a precise identification code within the geodatabase. The roads, or parts of the road, are identified according to transects, polyline segments, and all together define the road graph.

In Sicily, as of April 29, 2022, 330,038 transects have been identified, of which 27,780 are unclassified and 42 unknowns.

Some correspondence was also found between the road classifications of OSM and the Highway Code, in such a way as to obtain a relationship between the road type in OSM and the management according to the legal attribution indicated in the Legislative Decree of 31 March 1998, n. 112. Only roads that have not been classified under OSM (code 5121) remain to be classified.

4. An application of OSM to the case of the Sicani Internal Area

The check of the correct classification of the roads and the correct attribution of these to the related municipalities concerned an inland area of Sicily in the Province of Agrigento. Exactly twelve municipalities: Alessandria della Rocca (2,500 inhabitants), Bivona (3,226 inhabitants), Burgio (2,504 inhabitants), Calamonaci (1,173 inhabitants), Cattolica Eraclea (3,307 inhabitants), Cianciana (3,099 inhabitants), Lucca Sicula (1,729 inhabitants), Montallegro (2,369 inhabitants), Ribera (17,871 inhabitants), San Biagio Platani (2,878 inhabitants), Santo Stefano Quisquina (4,138 inhabitants), Villlafranca Sicula (1,342

inhabitants) with a population recorded as of 1 January 2022 (figure 4.1), for a total of 46,136 resident inhabitants, an area of 636.56 sq km, 5,964 road transects of which 542 are unclassified and a total of 2,252 km of roads (figure 1).

Figure 1 - *Sicani Internal Area and road grid.*
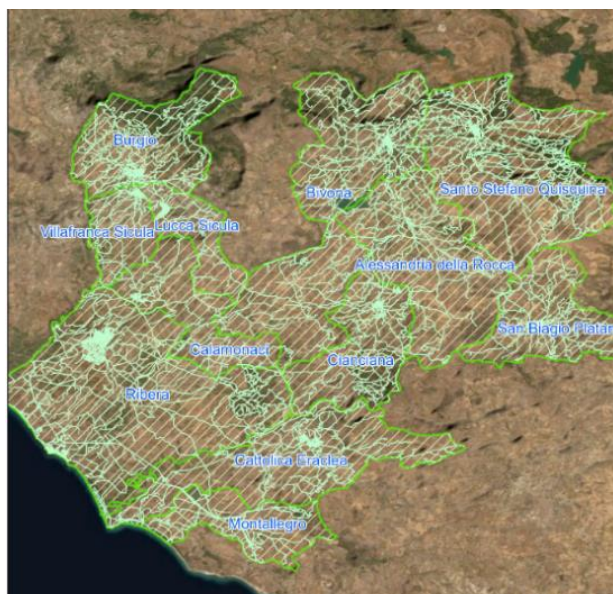
The semi-automatic procedure (figures 2 and 3) provided: **a)** the classification of transects that were not classified into OSM; **b)** the verification of the continuity of the classification of the transects, i.e., for example if a road is composed of three transects, the first and the last of which are classified *as track_grade1*, the central transect can only be classified in the same way, i.e., continuity is respected road classification; **c)** the elimination of duplication of transects, especially for the most important roads which may have two parallel transects for the two directions of the road when the carriageway is single; **d)** the overlap (*intersect* operation in ArcGIS PRO) (ESRI, 2022) of the information layers of the ISTAT Territorial Bases of ISTAT (ISTAT, 2011) with the areas of the *inhabited centre, inhabited nucleus, production locations and scattered houses*, and the road graph completely classified in OSM (figure 4.2). This procedure aimed to verify whether the roads already classified with a certain category respect the areas of the territory on which they pass and that is, for example, if a road that in an area outside the inhabited area is classified as a *secondary road*, its part, entering the built-up area must be classified as *residential* and must have a different code than its part outside the urban area; **e)** the exact calculation of the length, with an intersect operation

(*intersect* in ArcGIS PRO) with the municipal layers, of the roads by category and municipality. At the end of the process, all the lengths of the roads for each municipality belonging to the Sicani Internal Area were obtained, classifying one hundred percent of the transects (table 1).
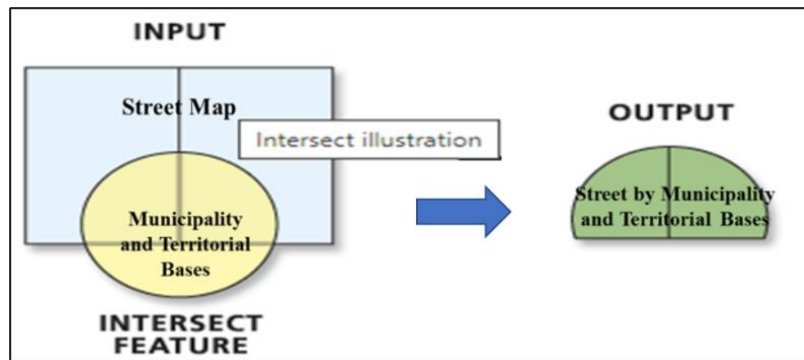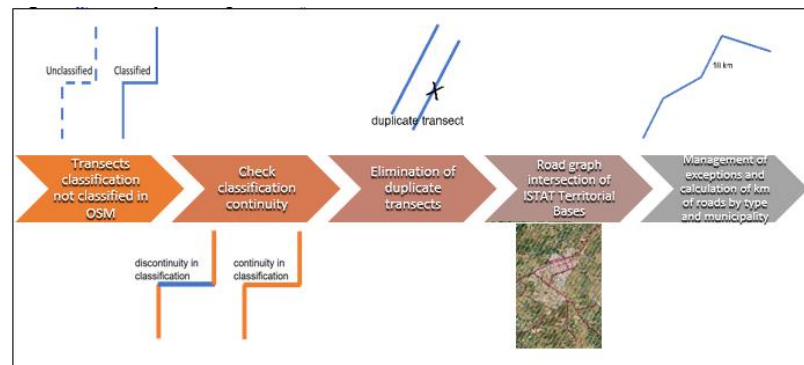
Figure 2 – *Intersect (Analysis).*

Figure 3 - *Classification process*

5. Some concluding remarks

There are many reasons why it is important to know the exact dimensions of the road infrastructure in a specific area. This knowledge allows for more efficient planning of public and private transportation, helps identify any shortages or overcrowding in the road system, enabling improvements to be made, allows for the evaluation of the impact of new development on the existing road network, and can be used to study road safety and identify potentially hazardous areas. Additionally, knowing the exact road infrastructure of an area is important for

evaluating the environmental impact of road traffic, such as atmospheric or noise pollution.

Table 1 - *Km of roads by type and municipality*

Road Type (km)	Alessandria della Rocca	Bivona	Burgio	Calamonaci	Cattolica Eraclea	Ciancina	Lucca Sicula	Montallegro	Ribera	San Biagio Platani	Santo Stefano Quisquina	Villafranca Sicula	Total
Cycleway											2,12		2,12
Footway		0,06	1,00		2,05	0,09	0,15		1,58	0,00	5,07		10,00
Living_Street								0,14	0,45				0,59
Path	5,20	18,02	14,01	2,28	4,33	8,61	0,09	1,84	6,81	2,48	29,94	0,22	93,82
Pedestrian		0,29	0,01				0,10		0,35		0,27		1,02
Primary	12,28	7,42			2,16	10,75		6,67	12,33		9,77		61,37
Residential	5,61	19,51	18,23	7,60	24,02	19,16	15,68	11,71	91,49	25,02	22,32	10,11	270,44
Secondary	8,47	5,98	8,38	7,21	2,04	13,76	0,61		38,66	21,56	23,32	11,63	141,62
Secondary_Link						0,27			1,00				1,26
Service	7,59	32,87	23,80	8,03	21,34	14,15	4,05	6,22	40,84	12,09	33,53	11,50	216,02
Steps		0,12	0,34		0,14	0,06	0,03	0,12	0,19	0,12	0,05		1,17
Tertiary	7,12	27,69	2,32	24,55	37,66	13,82	15,43	43,27	65,77	9,16	11,00	15,71	273,49
Tertiary_Link	0,20	0,13						0,09	0,46			0,06	0,94
Track		0,20	14,93		0,77		4,31	0,04	2,06		1,98	0,62	24,91
Track_Grade1	4,28	29,13	0,76	1,74	2,85	3,21	2,03	0,51	9,04	0,13	16,03		69,71
Track_Grade2	58,86	79,34	85,85	16,37	50,33	36,11	13,37	16,10	117,90	34,67	111,74	10,55	631,19
Track_Grade3	39,57	44,15	12,53	10,42	26,55	26,23	2,52	9,30	42,44	26,00	55,76	1,33	296,80
Track_Grade4	20,84	33,50	5,34	3,02	13,89	14,31	2,22	5,35	21,22	14,37	19,19	0,08	153,33
Track_Grade5	0,85	2,12		1,33	0,64					1,03	0,54		6,51
Total	170,87	300,53	187,50	82,55	188,77	160,52	60,57	101,35	452,59	146,62	342,61	61,81	2.256

In Italy, there are several sources of information that can be used to determine the exact dimensions of the road infrastructure in a specific area, which, however, describe different pictures of the road infrastructure. These sources include online maps such as Open Street Map, which provide up-to-date information on the Italian road network and can be used to accurately determine the dimensions of the road infrastructure in a specific area.

Open Street Map has its own classification system that does not align with that of the Italian Highway Code, which is a national system rather than international. While the Italian Highway Code categorizes roads based on their use, location, and management, Open Street Map provides a more detailed classification. Nevertheless, Open Street Map enables a thorough classification of streets and can help fill gaps in knowledge about an area, which is crucial for the planning of new territorial development policies.

The use of Open Street Map requires standardization and reconciliation between its road classification and the Highway Code, which requires careful attention to detail. In particular, the semi-automatic procedure for classifying transects becomes more time-consuming when there is a high number of unclassified transects, as manual checks of doubtful classifications must be performed. Verifying duplicates of transects on major streets is also challenging, as it requires examining each street individually. Another issue is accurately attributing road kilometers to managerial competence, which can be difficult due to the numerous exceptions in the Sicilian territory and the need to address each case individually. Overall, it is important to pay close attention to these issues to ensure accurate classification of roads.

References

ESRI **-** Intersect (Analysis) **-** https://pro.arcgis.com/en/pro-app/2.8/tool-reference/analysis/intersect.html

ISTAT. Description of geographic data and census variables of the territorial bases for censuses: years 1991, 2001, 2011.

ISTAT - Territorial bases and census variables https://www.istat.it/it/Archivi/104317

ISTAT – Experimental statistics – 'Utilizzo di open Street Map per il calcolo di indicatori per l'incidentalità stradale sulla rete viaria italiana' – July 2019

https://www.istat.it/it/files//2013/11/Descrizione-dati-Pubblicazione-2016.03.09.pdf

Legislative Decree 30 April 1992, n. 285 - New highway code

MIN. LL.PP. - Ispettorato Generale per la circolazione e la sicurezza stradale - 'Modalità di istituzione ed aggiornamento del Catasto delle Strade', prot. n. 3484, 2001

NATIONAL INFRASTRUCTURE AND TRANSPORT ACCOUNT, Years 2019-2020, Proposal for the revision of the national road network Government Act 91 – 92.

OPENSTREETMAP DATA IN LAYERED GIS FORMAT - Free shapefiles – 2021.

SUMMARY

An adequate road infrastructure system represents an essential and necessary condition to increase the productivity and competitiveness of a territory and to guarantee its development, especially with reference to the innermost areas. Continuous and huge financial investments are needed, the programming of which should be based on a clear knowledge and measurement of the road endowment up to the municipal level, which is not currently available. Open street map can represent a robust and reliable source of road equipment in a specific area on which public policies for the enhancement or safety of the road system intend to intervene. The OpenStreetMap (OSM) project since July 2004 has collected a huge amount of spatial data on a voluntary basis making it not perfectly standardized. Through an application to an Internal Area included in the National Strategy for Internal Areas (SNAI), the area of "Terre dei Sicani", we have determined the road distances present in each single municipality of the Area and for each road category, proceeding to an appropriate standardization. Through the use of particular GIS methodologies, the application proposes the resolution of some redundancies and criticalities present in OSM, which in some cases attribute additional road sections to the correct categories, assigning each single stretch of road to each municipality of the Area on the basis of its administrative limits.

_____

Riccardo ABBATE, Istituto Nazionale di Statistica, riabbate@istat.it
Alberto DOLCE, Istituto Nazionale di Statistica, dolce@istat.it
Rosario MILAZZO, Istituto Nazionale di Statistica, milazzo@istat.it
Antonio PANNICO, NVVIP, Regione Siciliana, antonio.pannico@regione.sicilia.it

THE PERMANENT POPULATION CENSUS AND NEW OPPORTUNITIES FOR ANNUAL DATA DISSEMINATION AT MUNICIPAL LEVEL: A FOCUS ON EMPLOYED PERSONS BY EDUCATIONAL ATTAINMENT IN ITALY'S LARGE CITIES[1]

Simone De Angelis, Simona Mastroluca, Valeria Quondamstefano

1. The new data dissemination opportunities of the Permanent Population and Housing Census

The first cycle of the Permanent Population and Housing Census ended in 2021. The new Italian census strategy foresees the integration of information from administrative sources and data collected annually through sample surveys. The Permanent Census has been designed based on the Italian National Institute of Statistics (Istat) modernization program which places the integrated system of statistical registers at the core of statistical production. The role of field surveys in this system is to support registers, in the broad sense of assessing their quality and to add information that is missing, incomplete or of insufficient quality (Gallo and Zindato 2021). The new census methodology has required a difficult revisiting of the process of producing and validating estimates while offering the ability to disseminate multidimensional tables more frequently. In fact, the usual decennial dissemination, moreover, regulated by European Union Regulations (Regulation (EC) No 763/2008, Regulation (EU) 2017/712, Regulation (EU) 2017/543, Regulation (EU) 2018/1799), is complemented by an annual informative supply on topics varying from the main demographic characteristics of the usual resident population to socio-economic features. It is a dynamic dissemination programme that can be reshaped over time according to the increasing availability of data from administrative sources and adjustments made each year to the contents of the sample surveys. The census, as known, ensures the availability of statistics at a territorial detail that cannot be guaranteed by any other survey. Studies are underway to identify the methodology suitable for producing the sub-municipal level estimates that are one of the census outputs most expected by users, especially by local government officials. A first set of these estimates should be ready by the first half of 2023.It means that, from the point of view of

---

[1] The article is exclusively expressing the authors' opinions. Although the paper is the result of joint work, sections are attributed as follows: paragraphs 1, 2.1 and 5 to Simona Mastroluca, paragraphs 2.2 and 4 to Simone De Angelis and paragraph 3 to Valeria Quondamstefano.

dissemination, the Permanent Census guarantees the availability of census statistics at the same classificatory and territorial details but with greater timeliness and frequency than before. The first municipality-level data related to 2018 and 2019 editions of the Permanent Census were published on Istat's institutional website starting from December 2020 and covered population by sex, age and citizenship, by educational attainment, current activity status (employed, unemployed and outside of the labour force) and commuting for study or work. Referring to the same years, information on the number of households and on the number of members classified by citizenship, Italian or foreign, were made accessible. In 2020, due to the pandemic crisis, the surveys were not carried out, which meant that Istat could not proceed with the estimation of some aggregates. In the new Italian strategy, in fact, variables have been classified as totally, partially or not replaceable. Totally replaceable variables are already included in the administrative sources; these variables are considered complete since they are available for all units in the Registers and accurate, having a good level of coverage and quality. Partially replaceable variables are considered complete and accurate only for a subset of the target population; for the others, the data are unknown or cannot be considered accurate. Finally, not replaceable variables are those not yet available from administrative sources. For partially or not replaceable variables, field-collected data are a requirement for producing reliable estimates at a high level of territorial detail. These variables include both current activity status and commuting, which therefore could not be included in the annual dissemination programme reported for 2020, which replicated those of 2018 and 2019 for all other cross tabulations. Activities related to the production and validation of the Permanent Census statistics are highly complex and still being refined. The analysis of administrative sources in terms of coverage, completeness and quality and the planning of annual surveys require significant investments of time and resources as well as the definition of estimation methodologies and the check of the results. Between December 2022 and early 2023, data referred to 2021 on the usual resident population by sex, age, citizenship, educational attainment and current activity status will be disseminated. The first information on conventional dwellings is also scheduled to be published by the end of 2022. Then, by March 2024, 119 multidimensional cross tabulations at different levels of geographical detail covering all Census topics, from demographic to socioeconomic variables, from internal and international migration to commuting, households and housing must be made available to Eurostat. These are the 119 "hypercubes" included in Regulation 2017/712 to be transmitted to the Commission that ensure the comparability of census data collected by all member states.

2. Education attainment and employment in Italy in 2019

2.1. Data sources

Educational attainment represents one of the Census population outputs most frequently requested by stakeholders. The data, broken down into eight categories ranging from illiteracy to PhDs at the municipal level, were estimated from the stock of individual information of the approximately 54 million persons surveyed at the 2011 Census and still residing in Italy in 2018 (Di Zio et al., 2019) These data were integrated, in the first instance, with information provided by the Ministry of Education and consolidated in the Education Data Base managed by Istat. Although the Ministry's data is the primary source for updating the 2011 Census, it shows an under coverage of some training courses and a delay ranging from 12 to 24 months. It was, therefore, necessary to use data collected through sample surveys in order to fill gaps related to courses administered by the regions, some tertiary degrees, postgraduate degrees (now available) and qualifications obtained abroad. Details on demographic characteristics (gender, age and citizenship) of the usual resident population classified by educational attainment were taken from the Population Base Register. The main reference source for estimating employment is the Employment Register which includes administrative signs of employment, retirement, study and variables related to income and monetary transfers (Istat, 2020). Specifically, the Employment Register integrates into a single data source information from the Annual Register on Wages and Labour Costs at the individual level, the Population Base Register and the information derived from the Labour Force and the Permanent Census Surveys.

2.2. More employed persons and graduates in Italy's Large Cities

In Italy, according to the estimate reported as of December 2019, there are 23.662.475 employed persons. More than 15% (3.634.928) of them reside in Italy's 12 Large Cities with Rome and Milan where the percentage of employed persons stands at 4.9% and 2.7%, respectively. The specific employment rate 20-64 years old (Figure 1) at the national level is 63.8%; Bologna has the highest value (73.4%) followed by Milan (72.1%) and Florence (71.8%) while Rome, at 65.5%, is 1.7 percentage points above the Italian total. In general, a different trend is clear across the territory. The Large Cities in northern and central Italy show employment rates considerably above the national figure; the greater municipalities in the South, on the other hand, present much lower rates, as far as Catania, which, with 46.8 percent, is in last place of the ranking.

**Figure 1 –** *Employment rate (20-64 years) in Large Cities.*
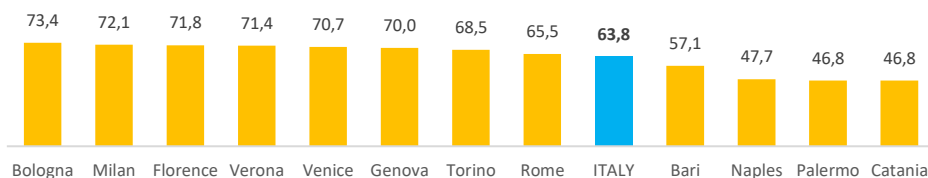
Source:Permanent Census 2019.

Analyzing employment by gender and citizenship, we can see that the north-south spatial characterization, which has already emerged for the employment rate, is also reflected in these two demographic topics. In Italy, out of every 100 employed persons aged 15 or over, 42 are women (Figure 2). In all Large Cities of the north and center, the percentage of employed women is, although slightly, above the national figure with the highest share recorded in Florence (47.5%) followed by Bologna (46.9%) and Rome (46.5%). The gender gap is very clear, on the contrary, in the south with Naples where, out of 100 employed, only about 38 are women.

Figure 2 *– Percentage employed women in Large Cities.*
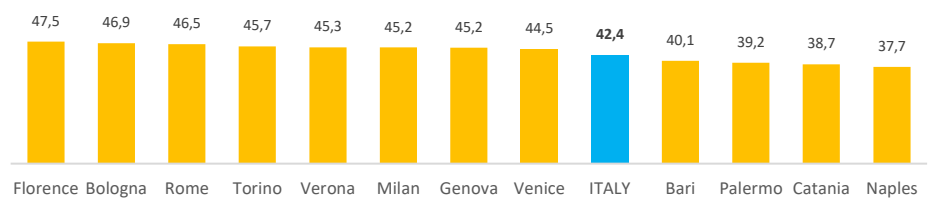
Source:Permanent Census 2019.

In 2019, 8.8 percent of employed persons have foreign citizenship (Figure 3). The north-south dualism appears even more evident in this case. Indeed, in all the Large Cities of the north and center, the percentage of foreign employment is above 10%, with Milan approaching the 20% threshold. In the south, employment opportunities for foreigners are significantly lower; in Bari the incidence of foreign employment is 4.1%, less than half the national average.

Figure 3 – *Percentage employed foreigners in Large Cities.*
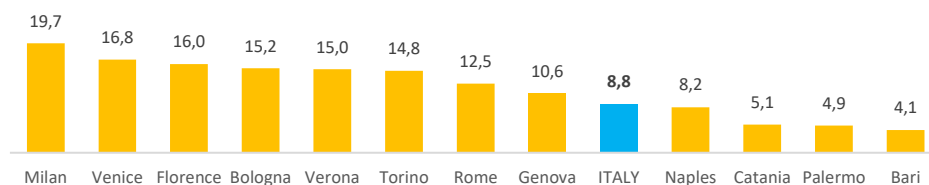
3. Employed persons by educational attainment in Italian Large Cities

In the twelve Italian Large Cities (Figure 4) the percentage of employed graduates (33,6%) is significantly higher than that recorded at the national level (22,6%). The employed persons with a upper secondary education or a lower secondary license living in big towns are, as a percentage, fewer than those recorded for the whole of Italy. Compared with 2011, the reference year of the last traditional Census, the percentage of employed graduates has increased both at national level (19.3 percent) and in Large Cities (30.7) while the gap between the two values remained almost the same (11 percentage points).

Figure 4 – *Employed persons by educational attainment. Italy and Large Cities.*
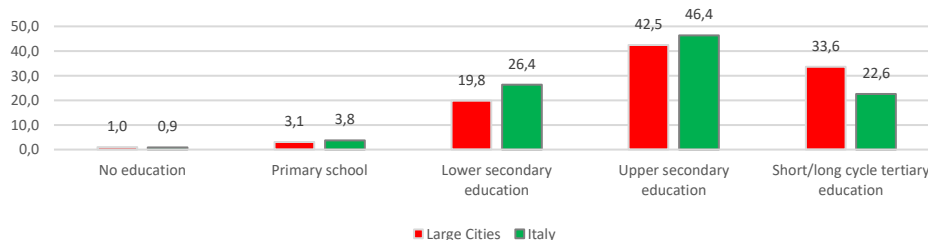
Source:Permanent Census 2019.

In Bologna and Milan in 2019, employed persons with a short or a long cycle tertiary education exceed 41.0%, 30.0% in Florence, Rome, Turin and Verona. Catania, Venice and Naples have the lowest percentages but still over the national value. In 2011, the percentage of employed people with a tertiary education never reaches the 40% threshold and ranges from 25% of Venice to 37.4% of Bologna. In the intercensal period, graduates increase in all Large Cities except Naples where it goes from 27.9% to 25.5%. (Figure 5).

Figure 5 – *Employed persons with Short/long cycle tertiary education in Large Cities.*
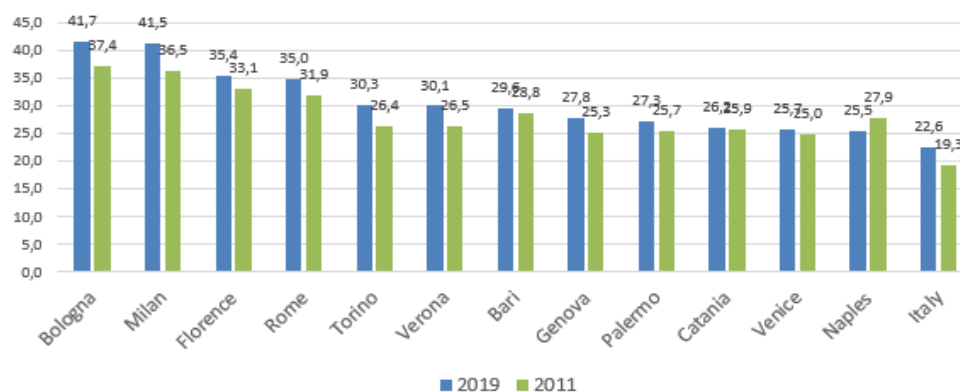
In 2019, the percentage of employed graduates out of total employed persons is significantly higher in the Large Cities than in the other Municipalities of the Metropolitan City/Province (Figure 6). In Bologna, employed graduates aged 20 or over represent 41.9% of the total employed in that age group, while in the other municipalities of the Emilian regional capital the share stops at 21.6 percent. The situation is quite the same in Milan where the difference between the figure of the Large Cities and that of the rest of the metropolitan city is 19 percentage points.

Figure 6 – *Employed graduates aged 20 years and over: Large Cities vs the remaining province. Permanent Census 2019.*
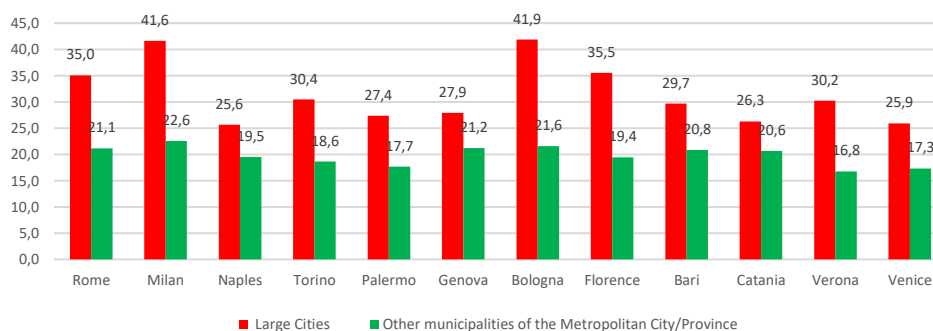
If we consider the deciles of the distribution, all the Large Cities are in the decile with the highest percentages of employed graduates, except for Catania (included in the second decile). Let us compare the two municipalities at the antipodes: Bologna with 41.9% of employed graduates and Catania, the only Large

City not in the decile of the most virtuous. Figure 7 shows the trends for Bologna and the other municipalities in the metropolitan city. The municipalities belonging to the percentile with the highest percentages of employed graduates are all bordering Bologna: San Lazzaro di Savena (33.6%), Casalecchio di Reno (31.1%), Castenaso (26.5%), Zola Predosa (26.0%) and Castel Maggiore (25.1%).

Figure 7 – *Percentage of employed graduates out of total employed Bologna vs the remaining province.*
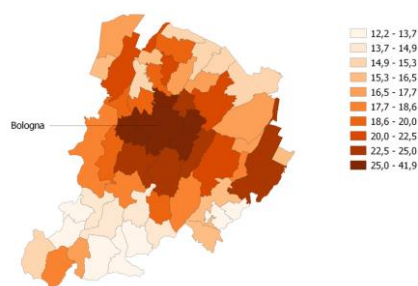
Source:Permanent Census 2019.

Figure 8 reports the performance of Catania (with 25.6% of employed graduates out of the total employed) and the other municipalities in the metropolitan city.

Figure 8 – *Percentage of employed graduates out of total employed Catania vs the remaining province.*
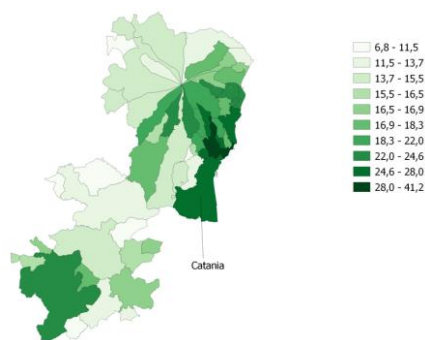
Source:Permanent Census 2019.

All the municipalities with the highest incidence of employed persons with a short or a long cycle tertiary education are neighbouring each other and are located on the northern border of Catania. The most virtuous municipality is Sant'Agata li Battiati (41.2%) while the greatest distance between contiguous municipalities in the ranking (5.2%) occurred between San Gregorio di Catania (39.8%) and Aci Castello (34.7%).

As for Rome and Milan, the gap from their most virtuous metropolitan city municipalities (Grottaferrata and Basiglio) is very low: 0.3 and 0.6. Turin differs from the most virtuous municipality (Pino Torinese) by 12.7 percentage points, Genoa by 8.4 (from Pieve Ligure) and Naples by 5.7 (from Portici).

4. Specific employment rates: more job opportunities for graduates

Specific employment rates related to the 20–64-year-old population (Figure 9) show that high educational attainments correspond to greater employment opportunities (Istat, 2021). Given an employment rate that in Italy stands at 63.8%, the rate for graduates is more than 11 percentage points higher and equal to 75.3%.

Among persons with an upper secondary education, the employment rate falls to 65.1% up to 58.3% pertaining to those with a lower secondary license. For people who attended only the primary school or who have not successfully completed a regular course of study, the rate ranges from 41.9% to 44.4%. The 12 Large Cities as a whole present greater employment attractiveness with regard to the graduates. Compared to the national figure (75.3%), in fact, the employment rate in this case is more than one percentage point higher and amounts to 76.4%. On the other hand, the rates for persons with a secondary education are lower in the most populated towns. In the Large Cities 49.4% of people without an educational qualification find work compared with 44.4% recorded in Italy and 43.1% of people with a primary school license (41.9% at national level). Italy's large urban realities, therefore, while attractive for high-skilled labour on the one hand, also seem to be no less attractive in the case of lower-skilled employment.

Figure 9 – *Employment rate (20-64 years) by educational attainment in 2019: Italy and Large Cities.*
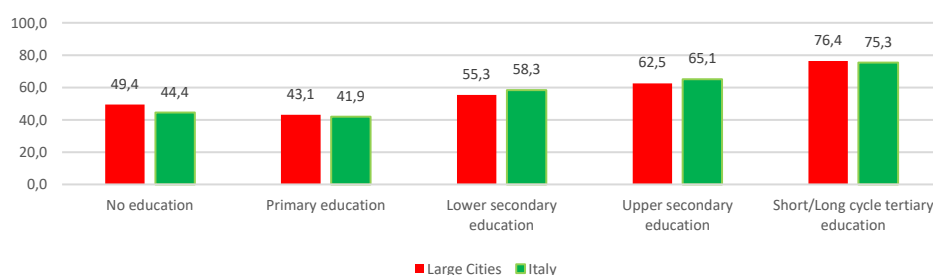
Source:Permanent Census 2019.

In Milan and Bologna, the employment rate of graduates exceeds 80.0% (Figure 10). Rome, with 74.7%, is slightly below the national figure (75.3 percent) while the lowest values are recorded in all southern municipalities with the minimums in Naples (66.8%) and Palermo (66.9%). Interesting, at the same time, are the differences that appear when comparing the employment rates of graduates versus persons with upper secondary education. The greater employment opportunities for the first ones are more evident in southern municipalities. In Catania, the employment rate of graduates aged 20-64 is more than 20 percentage points higher than those with a high school diploma, while in Naples and Palermo the gap is about 19 points. In Milan, the difference is just over 13 percentage points.

Figure 10 – *Employment rate (20-64 years) among graduates and upper secondary education in Large Cities.*
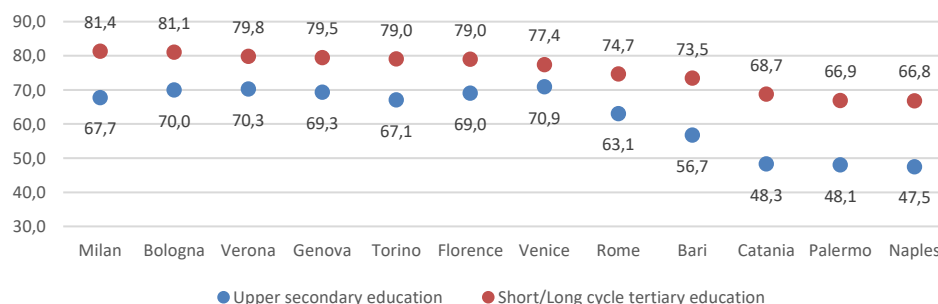
Source: Permanent Census 2019.

Breaking down the specific employment rate for graduates by citizenship, it shows that, compared to the national value (75.3%), for Italians the rate is 76.9% while for foreigners it is more than 20 percentage points lower settling at 54.6% (Figure 11). This means that the advantage gained, in terms of higher probability of employment, as the educational qualification increases, applies only to the Italian component and not to the foreign one. In any case, for foreign graduates, greater employment opportunities are in all the Large Cities of the north and particularly in Milan where the rate is 63.6%, followed by Venice (62.1%) and Verona (61.3%); the remaining southern municipalities highlight employment rates well below the national level with Catania and Bari where values are just above 43 percent.

Figure 11 − *Employment rate (20-64 years) by short/long cycle tertiary education and citizenship in Large Cities.*
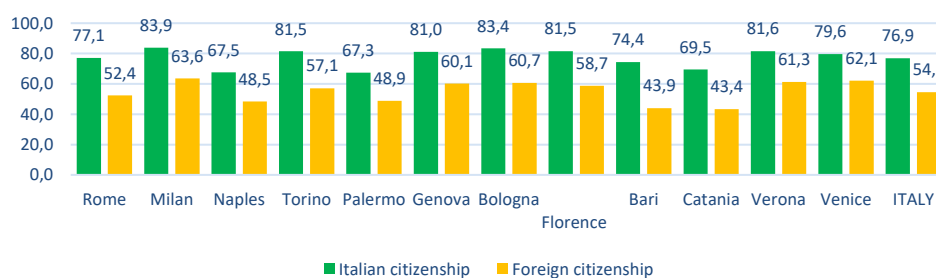
Source:Permanent Census 2019.

5. Conclusions

The work is a preliminary attempt that shows the informational potential of the Population Permanent Census. It allows not only the traditional 10-year data supply required by the International Regulations, but also the annual dissemination of a municipal-level dataset.   During 2023 it is also planned to disseminate sub-municipal level data particularly expected by stakeholders. The complexity of the new data production and validation process has so far caused the dissemination of a reduced number of cross tabulations. When fully operational, the goal is to offer an increasing set of hypercubes each year, thanks first of all to the enrichment of administrative sources in terms of coverage and quality. In this context, the relationship between employment status and educational attainment explored in the paper can be completed when more information will be available on job characteristics, such as occupation based on the ISCO, the International Standard Classification of Occupation, a topic necessary to explore, for example, the issue of overqualification.

Istat is currently processing data related to the 2021 wave of the Permanent Census in order to disseminate by December 2022 the population counts at municipal level and geocoded to the 1 km^2 reference grid (Regulation (EC) No 1799/2018) Some cross-tabulations on socio economic topics and on dwellings will be published as well. Istat is also planning the production of the 119 hypercubes included in the European Regulation 2017/712 establishing the reference year and the programme of the statistical data and metadata for population and housing censuses to be made available to Eurostat by 31st March 2024. Meanwhile in Europe the use of data from administrative sources is increasing and Eurostat is working to a dissemination program for post-2021 Censuses based on a more frequent data supply. The purpose is an annual and a multiannual data collection,

starting from the mid-2020s, while maintaining the traditional decennial data dissemination in 2031(Mastroluca and Verrascina, 2019). In simple terms, Italy is realizing, a few years in advance, the strategy that will be applied in all Member States of the European Union for the post-2021 Population and Housing Censuses.

References

DI ZIO M., FILIPPINI R., ROCCHETTI, G. 2019. An imputation procedure for the Italian attained level of education in the register of individuals based on administrative and survey data, *Rivista di Statistica Ufficiale,* No.2-3, pp. 143-173

EUROPEAN COMMISSION, 2017. Regulation (EU) 2017/543 Commission Implementing regulation (EU) 2017/543 of 22 March 2017 as regards the technical specifications of the topics and of their breakdowns, *Official Journal of the European Union*, Vol. 78, pp. 13-58.

EUROPEAN COMMISSION, 2017b, Regulation (EU) 2017/712 of 20 April 2017 establishing the reference year and the programme of the statistical data and metadata for population and housing censuses*, Official Journal of the European Union*, Vol. 105, pp. 1-11.

EUROPEAN COMMISSION, 2018. Implementing regulation (EU) 2018/1799 of 21 November 2018 on the establishment of a temporary direct statistical action for the dissemination of selected topics of the 2021 population and housing census geocoded to a 1 km2 grid, *Official Journal of the European Union*, Vol. 296, pp. 19-27.

EUROPEAN PARLIAMENT AND COUNCIL OF THE EUROPEAN UNION, 2008, Regulation (EC) 763/2008 of the European Parliament and of the Council of 9 July 2008 on population and housing censuses*, Official Journal of the European Union*, Vol. 218, pp. 14-20.

GALLO G., ZINDATO D., 2021. Italy: The combined use of survey and register data for the Italian Permanent Population Census count. In *UNECE, Guidelines for Assessing the Quality of Administrative Sources for Use in Censuses, 69th plenary session of the Conference of European Statisticians,* Vol. 1, Geneva: UNECE, pp.91-103

ISTAT, 2021. Statistiche Report: Livelli di istruzione e partecipazione alla formazione. Anno 2020*. Report Livelli di Istruzione 2020,* Roma, Istat.

ISTAT, 2020. Nota tecnica sulla produzione dei dati del Censimento Permanente: la stima della popolazione residente per sesso, età cittadinanza, grado di istruzione e condizione professionale per gli anni 2018 e 2019, *Nota Tecnica Censipop*, Roma Istat.

MASTROLUCA S., VERRASCINA M., 2019. The multiannual dissemination programme in the Italian Permanent Census of Population: towards more timely statistics. In *UNECE 2019. Conference of European Statisticians*, Geneva: UNECE, pp. 1-10

SUMMARY

The Permanent Census of Population and Housing, now in its fourth edition, enables the annual dissemination of municipal-level data on topics related to population by sex, age and citizenship, educational attainment, current activity status, commuting for study or work, and households. The new census strategy, based on the integration of data from administrative sources and from sample surveys, ensures not only the traditional ten-year information supply, but also the ability to produce and share with users multidimensional tables aimed at micro-level territorial knowledge with unprecedented frequency and timeliness. Moreover, the incremental availability of information included in the thematic Registers of the Italian National Institute of Statistics and the opportunity to change annually the informative contents of sample surveys, allows the dissemination programme to be modified every year. The paper aims to explore the cognitive advantages arising from the new census strategy while also providing an example of the use of the data produced annually at the municipal level. We will see, also through the construction of gender- and citizenship-specific indicators, how the territory influences the distribution of the employment rate in relation to the highest educational level obtained in a comparison between residents in the 12 Italian cities with more than 250,000 inhabitants and those living in the other municipalities of the province.

_____

Simone DE ANGELIS, Istat, sideange@istat.it
Simona MASTROLUCA, Istat, mastrolu@istat.it
Valeria QUONDAMSTEFANO, Istat, quondamstefano@istat.it

ATTIVITÀ DELLA SOCIETÀ

A) RIUNIONI SCIENTIFICHE

XXXVII	La mobilità dei fattori produttivi nell'area del Mediterraneo (Palermo, 15-17 giugno 2000).
XXXVIII	Qualità dell'informazione statistica e strategie di programmazione a livello locale (Arcavacata di Rende, 10-12 maggio 2001).
XXXIX	L'Europa in trasformazione (Siena, 20-22 maggio 2002).
XL	Implicazioni demografiche, economiche e sociali dello sviluppo sostenibile (Bari, 15-17 maggio 2003).
XLI	Sviluppo economico e sociale e ulteriori ampliamenti dell'Unione Europea (Torino, 20-22 maggio 2004).
XLII	Sistemi urbani e riorganizzazione del territorio (Lucca, 19-21 maggio 2005).
XLIII	Mobilità delle risorse nel bacino del Mediterraneo e globalizzazione (Palermo, 25-27 maggio 2006).
XLIV	Impresa, lavoro e territorio nel quadro dei processi di localizzazione e trasformazione economica (Teramo 24-26 maggio 2007).
XLV	Geopolitica del Mediterraneo (Bari, 29-31 maggio 2008).
XLVI	Povertà ed esclusione sociale (Firenze 28-30 maggio 2009).
XLVII	Un mondo in movimento: approccio multidisciplinare ai fenomeni migratori (Milano 27-29 maggio 2010).
XLVIII	150 anni di Statistica per lo sviluppo del territorio: 1861-2011. (Roma 26-28 maggio 2011).
XLIX	Mobilità e sviluppo: il ruolo del turismo. (San Benedetto del Tronto, 24-26 maggio 2012).
L	Trasformazioni economiche e sociali agli inizi del terzo millennio: analisi e prospettive (Università Europea di Roma, 29-31 maggio 2013).
LI	Popolazione, sviluppo e ambiente: il caso del Mediterraneo (Università Federico II di Napoli, 29-31 maggio 2014).
LII	Le dinamiche economiche e sociali in tempo di crisi (Università Politecnica delle Marche, 28-30 maggio 2015).
LIII	Mutamento economico e tendenze socio-demografiche tra sfide e opportunità (Università degli Studi Internazionali di Roma, 26-28 maggio 2016).
LIV	Mobilità territoriale, sociale ed economica: modelli e metodi di analisi (Università degli Studi Internazionali di Catania, 25-26 maggio 2017).
LV	Coesione sociale, welfare e sviluppo equo e sostenibile (Università degli Studi dell'Insubria, Varese 24-25 maggio 2018).
LVI	Benessere e Territorio: Metodi e Strategie (Università Politecnica delle Marche, Ascoli Piceno 23-24 maggio 2019).