GENDER GAP OF ITALIAN REGION:
A SYNTHETIC INDEX PROPOPOSAL[1]

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Abstract. Gender stereotypes are deeply ingrained in our culture and are a root cause of gender inequalities. Gender stereotypes can limit ability and aspirations to choose a field of study or training, pursue a professional career, and make simple life choices, like picking a hobby. Although inequalities still exist, the EU has made significant progress in gender equality over the last decades. There are numerous indices built for measure gender gap. In 2013, European Institute for Gender Equality (EIGE) released the Gender Equality Index (GEI), created to assess the levels of gender equality in Europe based on EU policies. This index is currently based on seven domains: work and money, knowledge, time, power, health, trust and safety, quality and life satisfaction. Our work intends to identify a measurement of the gender inequalities in the Italian region and the changes caused by COVID-19 pandemic.
Starting from the domains proposed by the GEI, integrated with some of the indicators of the Sustainable Development Goals (SDGs), eight dimensions were identified and a ninth of a more specific nature was added, called "Gender-based violence".

1. Introduction

Equality between women and men is a fundamental value of the European Union and is vital to its economic and social growth. The Gender Equality strategy 2020-2025 (EC, 2020) presents policy objectives and actions to make significant progress by 2025 towards a gender-equal Europe.

However, actually, gender gaps remain and, in the labour market, women are still over-represented in lower paid sectors and under-represented in decision-making positions. To study the phenomenon, already in 1995, the UNDP developed the Gender-related Development Index (GDI), which considered three domains: life

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expectancy and health, knowledge and standard of living. In 2013, EIGE released the Gender Equality Index (GEI), created to assess the levels of gender equality in Europe based on EU policies (EIGE, 2013). It does so by encompassing the universal caregiver model outlined by Fraser (1997), in which gender equality, as 'equal sharing of paid work, money, knowledge, decision-making power and time', is seen as central (Plantenga et al., 2009).

With 65.0 out of 100 points, Italy ranks 14th in the EU on the Gender Equality Index. Its score is 3.6 points below the EU's score (EC, 2023).

Since 2010, Italy's score has increased by 11.7 points, raising its ranking by seven places. This is one of the largest long-term improvements compared to other Member States. Since 2019, Italy's score has increased by 1.2 points; however, its ranking has remained the same (14th). Both long and short-term improvements are mainly due to a better performance in the domain of power.

During the last years, women, mostly mothers, have borne the brunt of the upheaval, including the more acute socioeconomic consequences of the COVID-19 crisis (EIGE, 2022). For the first time in a decade, gender inequalities in employment, education, health status and access to health services have grown in all European countries.

Starting from the domains proposed by the GEI and integrating with some of the indicators of the Sustainable Development Goals (SDGs), this work intends to identify a measurement of the phenomenon from 2018, in order to measure the changes in gender inequalities with the arrival of the pandemic and how they differ in the Italian regions, capturing the presence of gaps both in favour of men and women.

2. Methodology

Following the OECD indication for the composite indicator construction (OECD, 2008), the definition should give the reader a clear sense of what is being measured by the indicator. These are the steps:

1. Theoretical framework. Provides the basis for the selection and combination of variables into a meaningful composite indicator under a fitness-for-purpose principle.

2. Data selection. Analytical soundness, measurability, municipalities' coverage, and relevance of the indicators to the phenomenon being measured and relationship to each other.

3. Imputation of missing data.

4. Normalization. To render the variables comparable.

5. Weighting and aggregation. Select appropriate weighting and aggregation procedure(s) that respect both the theoretical framework and the data properties.

6. Uncertainty and sensitivity analysis. To assess the robustness of the composite indicator in terms of e.g., the mechanism for including or excluding an indicator, the normalisation scheme, the imputation of missing data, the choice of weights, the aggregation method.

Being gender inequality a multidimensional concept, we added to the 8 domains, a ninth one, gender-based violence (Table 1). Starting from 134 indicators analysed, at the end, 51 indicators was been chosen (Appendix).

The work of selection the indicators, for each domain, involved finding a delicate balance between the need to satisfactorily measure the nine domains and: data availability (only regional indicators classifiable by gender have been taken into consideration); feasibility (the availability of obtaining and processing updated data in a simple way has been taken into account); timeliness of the data to ensure an adequate time comparison; thematic appropriateness.

Our model of measurement is formative, since indicators are considered as causing the gender gap (rather than being caused by it, such as in the reflective approach), so, the correlations between basic indicators are not very relevant. According to this approach, indicators are not interchangeable.

In order to capturing the different forms of inequality rather than the single levels, we didn't use absolute levels of indicators, but we have calculated relative indices (female-to male ratios).

Each indicator is calculate for male, female and total, while the ratio female on male gives the gap. Therefore, the gap is plus then one if it is in favour of female, minus then one if it is in favour of male.

Table 1 − *Number of indicators per Domain.*

Domains	Number of indicators analysed	Number of indicators chosen
Knowledge	17	6
Work and money	27	13
Power	6	4
Health	23	4
Well-being		5
Trust and safety	6	5
Quality and life satisfaction.	28	5
Time	15	3
Gender-based violence	12	6
Total	134	51

Table notes: authors' elaboration

In order to construct our gender inequality index, we follow the composite indicators approach computing a composite index for each single domain.

For this research, the Adjusted Mazziotta–Pareto Index (AMPI) is applied. The AMPI is a non-compensatory (or partially compensatory) composite index that allows comparability of the data across units and over time (Mazziotta and Pareto, 2016; 2017). It is a variant of the Mazziotta–Pareto Index (MPI), based on a re-scaling of the individual indicators by a Min–Max transformation, in contrast with the classic MPI where all the indicators are normalized by a linear combination of z-scores (De Muro *et al.*, 2011) and a re-scaling of the basic indicators in a range (70; 130). It is the best solution for a multi-year analysis.

Given the original matrix X_{ij}, where *i=1,...,n* are the units of analysis (the Italian regions) and *j=1,..,m* are the basic indicators, we calculate the normalized matrix as follows:

$$r_{ij} = \frac{\left(x_{ij} - Min_{x_j}\right)}{\left(Max_{x_j} - Min_{x_j}\right)} \; x \; (60 + 70)$$

where x_{ij} is the value of the indicator j in the unit i and Min_{xj} and Max_{xj} are the goalposts for the indicator j. Let Inf_{x_j} and Sup_{x_j} be respectively the minimum and the maximum values of indicator j across all regions and all time periods considered, and Ref_{x_j} be the reference value for indicator j. Then the "goalposts" are defined as: $Max_{x_j} = Ref_{x_j} + \Delta$, and $Min_{x_j} = Ref_{x_j} - \Delta$, where $\Delta = (Sup_{x_j} - Inf_{x_j})$ /2. The adjusted MPI is given by:

$$AMPI^{\pm} = \; \mu_{r_i} \pm \; \sigma_{r_i} * cv_i$$

where r_i is the normalized value of the indicator, μ_{r_i}, σ_{r_i} and $cv_i = \sigma_{r_i} / \mu_{r_i}$, are the mean, the standard deviation and the coefficient of variation of the unit i and the sign ± depends on the kind of phenomenon measured. If all the composite indices are positive, i.e., increasing values of each index correspond to positive variations of the gender gap in a specific domain, AMPI⁻ is used, otherwise AMPI⁺

3. Results: Quality and life satisfaction

To experiment the methodology we have chosen the domain "Quality and life satisfaction". The choice depended by the availability of all simple indicators at same time and the low number of the indicators.

The means and the standard deviations for each simple indicator (Table 2) show how the indicators have moved over the years by sex. On average, in Italy, for all domain indicators, men have higher values than women.

Table 2 – *Domain Quality and life satisfaction: Means and Standard deviation for each indicator at national level.*

Quality and life satisfaction					
	2018 M(SD)	2019 M(SD)	2020 M(SD)	2021 M(SD)	2022 M(SD)
Indicator	**Female**				
Positive judgement of future perspectives	26.93 (2.63)	27.84 (3.25)	26.25 (2.38)	29.66 (2.56)	27.57 (3.12)
Free time satisfaction	65.29 (5.41)	66.83 (5.59)	68.54 (4.56)	56.23 (4.35)	64.19 (5.44)
Life satisfaction	41.97 (8.21)	44.24 (7.44)	45.20 (6.81)	45.92 (5.85)	46.00 (6.06)
Friends relationships satisfaction	23.37 (5.31)	22.58 (3.74)	22.54 (6.80)	18.79 (3.71)	21.31 (4.90)
Family relationships satisfaction	33.66 (6.22)	33.09 (4.68)	33.33 (6.29)	31.89 (5.31)	32.17 (6.67)
	2018 M(SD)	2019 M(SD)	2020 M(SD)	2021 M(SD)	2022 M(SD)
Indicator	**Male**				
Positive judgement of future perspectives	30.29 (3.08)	31.08 (3.39)	29.81 (3.16)	32.91 (3.31)	30.21 (2.81)
Free time satisfaction	68.97 (4.36)	70.94 (4.13)	72.49 (4.05)	60.05 (3.47)	68.53 (3.92)
Life satisfaction	45.43 (8.35)	46.84 (7.25)	48.15 (6.83)	48.90 (5.36)	49.60 (6.11)
Friends relationships satisfaction	25.00 (4.34)	24.62 (2.84)	23.26 (4.42)	20.01 (2.93)	23.66 (4.01)
Family relationships satisfaction	34.58 (6.17)	34.40 (4.57)	33.50 (5.65)	32.84 (5.28)	33.71 (5.87)

Table notes: authors' elaboration

As we expected, almost all the indicators of this domain suffer a decrease in the 2021 year. Except for the "Positive judgement of future perspectives" that grow up in 2021 particularly for women (+10.3% respect to year 2018). Also the indicator "Life satisfaction", with a bigger standard deviation, grow during the pandemic: from 41.97 (2018 y.) to 45.20 (2021 y.) for women and from 45.43 (2018 y.) to 48.15 (2021 y.) for men. For both men and women, in 2021 the "Satisfaction for free time" presented the lowest values (56.23 for female and 60.05 for male), even if this indicator is generally higher for men.

"Satisfaction for Friends relationships" decreased in the years up to 2021, in 2022 there was a change in trend, while the level of "Family relationships satisfaction" has been almost stable over the years.

Figure 1 – *Domain Quality and life satisfaction: Box plot, male and female per year.*
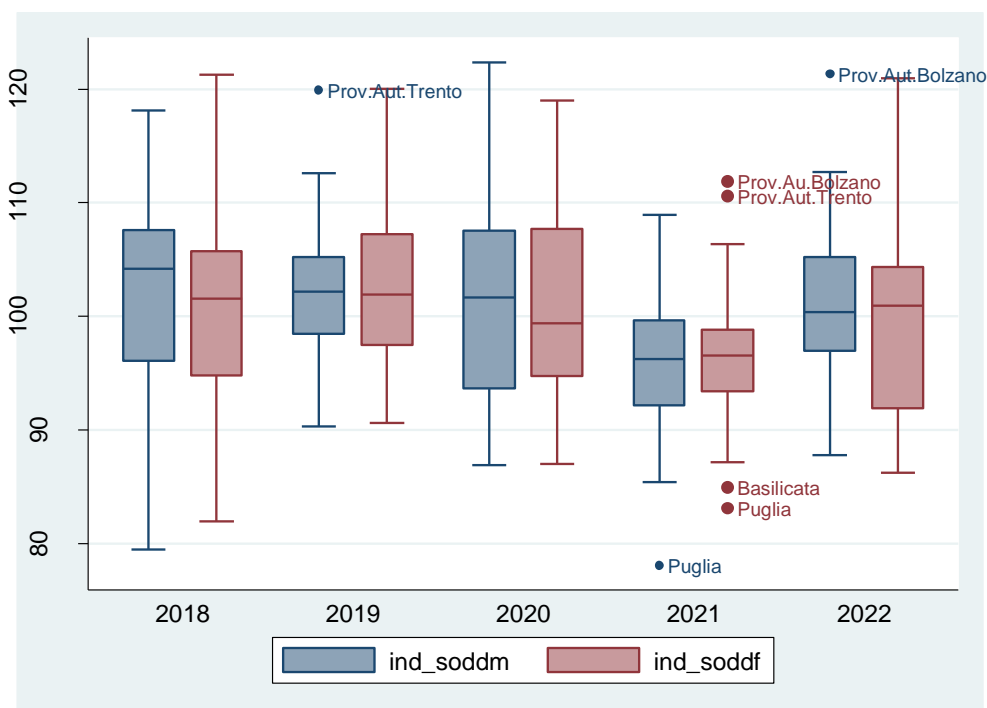

Figure notes: authors' elaboration

The box plot (Fig. 1) underline significant results for the synthetic indices calculated by sex. Males are represented with blue colour, females with pink colour; the "whiskers" are the maximum and minimum, the rectangle is the variability (interquartile difference), the points are the outliers. In 2018, there is a high variability and male satisfaction levels are higher. Over time, the differences between women and men are reduced, except in 2020. It is clear a less variability of the phenomenon in 2021 with low average values. In Puglia region, both for male and female, the values are particularly low in the same year (also in Basilicata for women), whereas in the provinces of Trento and Bolzano the "Quality and life satisfaction" is particularly high for women. Instead, in 2020, the year of greater uncertainty, greater variability is observed with higher average values for males respect to females.

In 2022 the average values start to increase again, even if with greater variability, more marked for women. In this year women have higher levels of satisfaction.

Table 3 – *Domain Quality and life satisfaction: regional synthetic index.*

Regions	Quality and life satisfaction index				
	2018	**2019**	**2020**	**2021**	**2022**
Abruzzo	90.8	93.6	95.4	103.2	93.3
Basilicata	101.5	98.6	100.6	72.1	75.6
Calabria	96.0	98.9	100.1	101.8	100.7
Campania	102.1	93.1	102.4	97.1	93.8
Emilia-Romagna	101.9	97.1	103.7	102.4	105.3
Friuli-Venezia Giulia	92.9	105.2	96.8	89.2	96.2
Lazio	97.9	97.7	104.2	95.3	96.7
Liguria	97.4	102.5	100.4	96.9	98.9
Lombardia	106.4	102.5	99.4	89.2	98.5
Marche	99.9	96.3	108.6	97.6	93.9
Molise	99.5	86.4	94.5	110.1	81.2
Piemonte	102.8	104.9	98.0	103.4	98.4
Provincia Autonoma di Bolzano/Bozen	110.3	105.1	109.4	107.0	103.4
Provincia Autonoma di Trento	104.1	100.8	99.4	101.2	110.5
Puglia	90.0	98.9	91.9	102.1	98.6
Sardegna	87.3	97.8	95.9	92.8	104.6
Sicilia	96.9	91.2	95.1	92.5	95.2
Toscana	98.8	102.2	98.0	99.1	96.9
Umbria	83.4	88.7	94.3	99.7	98.9
Valle d'Aosta/Vallée d'Aoste	96.7	103.7	98.9	113.6	96.5
Veneto	101.4	93.1	105.6	98.9	91.4
North	103.1	100.6	101.2	96.5	98.8
North-est	101.1	97.0	104.1	99.8	98.6
North-west	104.5	103.1	99.1	93.9	98.8
Center	97.5	98.5	102.0	97.4	96.9
South and islands	95.7	94.9	97.2	97.2	96.2
South	96.5	95.9	98.2	99.3	95.4
Islands	94.2	93.1	95.3	92.8	97.6
Italy	**100.0**	**98.5**	**100.2**	**97.0**	**97.8**

Table notes: authors' elaboration

The synthetic results, where Italy in 2018 is used as a benchmark value, show different context between both Regions and Macro-regions (Table 3). All values upper 100 highlight situations in which the gap against women is lower than in Italy.

It is interesting to note that, at the macro area level, the differences of the index values flatten out towards 100 over the years. During the first wave of pandemic, 2020, there was a reduction of the gap in favour of women (except in North-west).

In South, the gap continued the reduction in favour of women in 2021, but in 2022 it was grow up to the disadvantage of women.

The worst female situation for Quality and life satisfaction is in Basilicata for 2021 (72.1) and 2022 years (75.6). This result is mainly influenced by the indicator Friends relationships satisfaction, particularly low (0.63, 2021 y, and 0.68, 2022 y). While, the best performances are achieved by Valle d'Aosta in 2021 (113.6, with Positive judgement of future perspectives equal to 1.04, Friends relationships satisfaction equal to 1.3 and Satisfaction with family relations equal to 1.00), Trento in 2022 (110.5), with simple indicator high in mean, and Bolzano in 2018 (110.3), thanks to high values for the indicators Friends relationships satisfaction (1.19) and Satisfaction with family relations (1.03). Unusual the situation of Sardinia where the gap has gone from being in favour of men in 2018 year (87.26) to being in favour of women in 2022 (104.61) thanks to results obtained for the indicators Positive judgement of future perspectives (1.00), Friends relationships satisfaction (1.10) and Satisfaction with family relations (1.03).

4. Conclusions and final remarks

Following the EU regulations, gender equality was included as one of the three crosscutting missions of the National Plan, alongside those dealing with generational and regional disparities (Donà, 2022). As Italy's Recovery and Resilience Plan was, in terms of resources, the largest national plan under the RRF, it has the potential to be a 'turning point' for gender equality in Italy. This underline the importance of a measurement of the phenomenon at regional level. The choice of the most suitable model was not easy.

The selection of the 51 indicators was a complex choice, weighted considering:

- Data availability. Only regional indicators classifiable by gender have been taken into account;
- Feasibility. The availability of obtaining and processing updated data in a simple way has been taken into account;
- Timeliness of the data to ensure an adequate time comparison;
- Thematic appropriateness.

The idea is the construction of a composite index for each domain because the loss of information deriving from the calculation of a single index, which further summarizes the domains, would lead to the exclusion of the possibility of undertaking this choice. Moreover, the normalization process implements an "implicit" weighting which is also difficult to quantify. Specifically, the min-max normalization depends on how wide the gap between the maximum and minimum value is from a temporal point of view and by how big the regional gap is for each

single indicator. This is a relevant issue especially if an indicator is analysed from a temporal point of view because even significant advances in percentage terms (of the elementary indicator) could translate into very small advances of the normalized indicator. However, the construction of a regional ranking, alongside the reading of individual domains, could represent an important information input for monitoring the phenomenon over time. The results obtained for the domain Quality and life satisfaction show the goodness of the chosen approach. This allows proceeding with the calculation of the other domains and the synthetic index as next steps.

Appendix

Simple indicators	Domains
Adequate nutrition	Well-being
Alcohol consumption	Well-being
Overweight or obesity	Well-being
Smoking	Well-being
Sedentariness	Well-being
People with high level of IT competencies	Knowledge
Reading books and newspapers	Knowledge
Early leavers from education and training	Knowledge
People having completed tertiary education (30-34 years old)	Knowledge
STEM graduates	Knowledge
People with at least upper secondary education level (25-64 years old)	Knowledge
Young people neither in employment nor in education and training (NEET)	Work and money
Cultural employment	Work and money
Share of employed persons with temporary jobs for at least 5 years	Work and money
Share of over-qualified employed persons	Work and money
Involuntary part time	Work and money
Share of employed persons who feel their work unsecure	Work and money
Proportion of time spent on unpaid domestic and care work	Work and money
People at risk of poverty	Work and money
Job satisfaction	Work and money
Employment rate (20-64 years old)	Work and money
Gender pay gap	Work and money
Pensions	Work and money
Pension expenditure	Work and money
Share of members of Regional Assemblies	Power
Share of members of Managers Regional Assemblies	Power
Share of members of Municipal councils	Power
Share of members of Municipal commettee	Power
Mental health	Health
Life expectancy at birth	Health

Simple indicators	Domains
life expectancy without limitations at age 65	Health
Healthy life expectancy at birth	Health
Safe walking alone at night in the city/ area where you live	Trust and safety
Relatives/friends you can count on to help you	Trust and safety
Victims of blows	Trust and safety
Victims of sexual violence	Trust and safety
Victims of stalking	Trust and safety
Positive judgement of future perspectives	Quality and life satisfaction.
Leisure time satisfaction	Quality and life satisfaction.
Life satisfaction	Quality and life satisfaction.
Satisfaction with friends relations	Quality and life satisfaction.
Satisfaction with family relations	Quality and life satisfaction.
Volunteered the time to an organization	Time
Civic and political participation	Time
Persons aged 3 and over practising sports	Time
Households for women	Gender-based violence
Anti-violence centers	Gender-based violence
Female victims of blows	Gender-based violence
Female victims of stalking	Gender-based violence
Female victims of family violence	Gender-based violence
Female victims of sexual violence	Gender-based violence

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