

Wellbeing of Italian provinces through a multi-group approach

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1. Introduction

For over thirty years now, a widely accepted view is that gross domestic product (GDP) is an inadequate measure of a society's progress. Among the many arguments related to its inadequacy, the main one is the idea that GDP, although it can be used to some extent as a proxy for economic growth, is unable to capture everything that is not strictly economic (Stiglitz et al., 2010). In Italy, the BES project (from the Italian "Benessere Equo e Sostenibile," meaning Equitable and Sustainable Wellbeing), was started in 2010 by Istat and Cnel (Italian National Council for Economics and Labor), and it was aimed at measuring the progress of Italian society and providing a comprehensive and multidimensional statistical framework to monitor societal wellbeing, going beyond the purely economic measurements provided by GDP. To describe wellbeing in Italy, 12 domains were identified encompassing objective and subjective aspects: Health, Education and training, Work and life balance, Social relationships, Economic wellbeing, Politics and institutions, Safety, Subjective wellbeing, Landscape and cultural heritage, Environment, Innovation research and creativity, Quality of services.

The BES is updated annually, providing a complete overview of Italy's societal wellbeing. Considering the complexity, abstract nature, and multidimensionality of BES, its accurate measurement requires a wide range of statistical measures, while for the composition of the information provided by individual indicators, it is useful to adopt a tailored technique. In this paper we propose the use of partial least squares - path modeling (PLS-PM) (Wold, 1985). Specifically, a hierarchical model is constructed, with BES as the higher-order construct and other domains situated hierarchically beneath it, contributing to its measurement. The sudden onset of the Covid-19 pandemic, affecting the entire Eurozone and particularly vulnerable countries like Italy, has unveiled new needs and inequalities, exacerbating pre-existing concerns in the country.

The aim of this paper is to compare the pre-pandemic situation with the situation during the pandemic, attempting to quantify the Covid-19 effects on the BES and its components. To achieve this, two models are constructed: one for 2019 and one for 2020 (with the same indicators measured in two different years), followed by a comparison of path coefficients between the two years, so to assess potential changes. To achieve this goal, we refer to the limited literature on PLS-PM for longitudinal data (Roemer 2016) adjusting some approaches typically used in multigroup approach (MGA) (Sarstedt et al., 2011). The models are constructed and measured at small-region level (Nuts3), using the BES at local level indicators (Istat 2022) because more granular data allow a better appreciation of wellbeing levels changes and differences¹.

2. Methods

The estimation of the model was preceded by a thorough preliminary analysis with the aim of identifying those indicators that are available for the two selected years and suitable for the methodology used (for details see the concepts of assessment and validation in PLS-PM (Sarstedt

¹ [https://www.istat.it/it/benessere-e-sostenibilita/la-misurazione-del-benessere-\(bes\)/il-bes-dei-territori](https://www.istat.it/it/benessere-e-sostenibilita/la-misurazione-del-benessere-(bes)/il-bes-dei-territori)

et al., 2019). Figure 1 shows the model structure: we employed 36 indicators for each year, divided into 12 sub-blocks and 10 domains. The domains are further grouped into two major blocks (*Outcome* and *Context* domains) in accordance with the model proposed by Davino et al. (2018). There are 10 domains used because *Subjective wellbeing* is not measured at the sub-regional level, while no indicators were available for Innovation research and creativity updated to 2020.

The objective of this paper is to use PLS-PM in longitudinal studies and to apply a multigroup approach to quantify the effects of the Covid-19 crisis on the BES levels in the different domains at local level. The application of PLS-PM in longitudinal studies is relatively limited in the literature, despite it being a highly useful technique for assessing changes in constructs over time, due to its advantageous methodological features such as construct prediction, suitability for small sample sizes, and handling highly complex models (Henseler et al., 2009; Roemer, 2016).

After estimating a separate model for each year, a multigroup analysis is performed where each of the two models represents one group. Specifically, a non-parametric test, the “Bootstrap MGA” is implemented to understand if the coefficients of the model in Figure 1 (called path coefficients in the PLS-PM terminology) between the two years are significantly different from each other. This approach compares each bootstrap estimates from one group with all the other bootstrap estimates of the same parameter in the other group, and then counts how many times the estimate from the first group is greater than the second. The result is a one-tailed test probability, indicating the probability that the estimate from the first group is greater than the second one. We run the bootstrapping procedure with 5,000 subsamples (Hair et al., 2011).



Figure 1: Structure of the model

3. Results

Table 1 presents the path coefficients for 2019 and 2020. When moving from one year to another, the hierarchical order of domains changes only slightly: *Work and life balance* remains the domain with the highest impact in both 2019 and 2020, followed by *Education and training*, *Economic wellbeing*, and *Environment*. When comparing the two years, it is interesting to note the substantial decrease in the role of *Health* dimension, which essentially drops by about half. Notably, this decrease occurs in conjunction with the Covid-19 pandemic. After *Health*, the dimension that varies the most is *Environment*. While the change in *Health* is negative due to the pandemic's effects, the change in *Environment* is positive. During the pandemic there was a reduction in waste production, because of lockdown measures that forced commercial activities to close.

Also, we implemented a multigroup approach to see if the path coefficients between the two years are significantly different from each other. Table 2 reports the differences between the path coefficients with their corresponding p-values (in the third column) from the Bootstrap-MGA test. The two domains we mentioned earlier, *Health* and *Environment*, are the only ones that change significantly (at a 5% significance level). However, it may be considered that the BES indicators do not all have the same temporal variability, indeed many indicators have a certain latency period, meaning they need to be monitored for a longer period to observe the changes they record.

Table 1: Path coefficient values in both years

Latent variables		Path coefficients		
		2020		2019
Outcome	<i>Health</i>	0.049	0.882	0.133
	<i>Education and training</i>	0.280		0.275
	<i>Work and life balance</i>	0.330		0.304
	<i>Economic wellbeing</i>	0.169		0.153
	<i>Social relationships</i>	0.080		0.077
	<i>Safety</i>	0.131		0.119
	<i>Landscape and cultural heritage</i>	0.061		0.051
	<i>Environment</i>	0.176		0.119
Context	<i>Politics and institutions</i>	0.280	0.159	0.295
	<i>Quality of services</i>	0.878		0.851

Table 2: Results of Bootstrap-MGA test

Latent variables	Differences (2020 - 2019)	p-value
<i>Health</i>	-0.085	0.000
<i>Education and training</i>	0.005	0.812
<i>Work and life balance</i>	0.027	0.246
<i>Economic wellbeing</i>	0.016	0.282
<i>Social relationships</i>	0.004	0.844
<i>Politics and institutions</i>	-0.015	0.898
<i>Safety</i>	0.012	0.354
<i>Landscape and cultural heritage</i>	0.010	0.637
<i>Environment</i>	0.057	0.024
<i>Quality of services</i>	0.027	0.749
<i>Outcome domains</i>	-0.009	0.777
<i>Context domains</i>	0.016	0.659

Table 3: Average of Health for the different years and Italian geographic area

Geographic area	Health 2019 (average)	Health 2020 (average)
North-West	0.059	-0.876
Noth-Est	0.677	0.461
Center	0.548	0.774
South and islands	-0.748	-0.139

Taking this latency period into account is crucial for correctly interpreting variations in the data within the context of pandemic conditions and to avoid possible incorrect or hasty interpretations of the changes observed. Looking at the territorial heterogeneity, it is possible to quantify the Covid effect by considering the averages of the *Health* score in the two years (Table 3). This allows us to appreciate how much the provinces in the North-West of Italy have experienced significant reductions in *Health* scores between 2019 and 2020.

4. Conclusion

Since the objective of this paper was to quantify the effects of the pandemic on regional inequalities via the different BES domains, we have observed, as expected, that the most significant change between 2019 and 2020 occurred in the domain of *Health*. The pandemic had a substantial effect on *Health* differences among Italian provinces, as evidenced by the significant reduction in the path coefficient of *Health* on the *Outcome* domains, which is equal to 0.085. Levels of *Health* worsen in those provinces that in 2019 had the highest *Health* levels. As a result of this downward convergence, the contribution of the *Health* domain to wellbeing differences at local level reduced. These data reflect a range of challenges and negative changes that the pandemic has had on people's wellbeing, including the geographical spread of the virus itself during 2020.

It may be acknowledged that the dimensions of the BES had different response times to the pandemic shock. Therefore, for a more complete study, it is appropriate to analyze the changes in the complex structure of the BES and the evolution of regional differences in wellbeing even after 2020 year (which we are starting to do from the second half of 2023, as soon as the updates are available). In summary, this study highlights the importance of modelling data in a way that is sensitive to the specific vulnerabilities and response capacities of the units of analysis (in our case, Italian provinces) so that we have accurate indications to guide policy as well.

References

- Davino, C., Dolce, P., Taralli, S., Vinzi, V. E. (2018). A quantile composite-indicator approach for the measurement of equitable and sustainable well-being: A case study of the Italian provinces. *Social Indicators Research*, **136**, pp.999-1029.
- Hair, J.F., Ringle, C.M., Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice*, **19**(2), pp.139-152.
- Henseler, J., Ringle, C.M., Sinkovics, R.R. (2009). The use of partial least squares path modeling in international marketing. In *New Challenges to International Marketing*. Emerald Group Publ. Ltd.
- Jacobs, N., Hagger, M.S., Streukens, S., De Bourdeaudhuij, I., Claes, N. (2011). Testing an integrated model of the theory of planned behaviour and self-determination theory for different energy balance-related behaviours and intervention intensities. *British Journal of Health Psychology*, **16**(1), pp.113-134.
- Roemer, E. (2016). A tutorial on the use of PLS path modeling in longitudinal studies. *Industrial Management Data Systems*, **116**(9), pp.1901-1921.
- Sarstedt, M., Hair Jr, J.F., Cheah, J.H., Becker, J.M., Ringle, C.M. (2019). How to specify, estimate, and validate higher-order constructs in PLS-SEM. *Australasian Marketing Journal*, **27**(3), pp.197-211.
- Sarstedt, M., Henseler, J., Ringle, C. M. (2011). Multigroup analysis in partial least squares (PLS) path modeling: Alternative methods and empirical results. In *Measurement and Research Methods in International Marketing* (pp. 195-218). Bingley: Emerald Group Publishing Limited.
- Stiglitz, J.E., Sen, A., Fitoussi, J.P. (2010). *La misura sbagliata delle nostre vite. Perché il PIL non basta più per valutare benessere e progresso sociale*. Rizzoli, Milano.
- Wold, H. (1985). Partial least squares. In S. Kotz & N. L. Johnson (Eds.), *Encyclopedia of Statistical Sciences*. New York: Wiley.