The Istat Economic Sentiment Indicator: a new proposal

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Abstract

The Istat Economic Sentiment Indicator (IESI) is a measure of the confidence climate in the Italian production sector. It is the result of the aggregation of the variables used in the calculation of the confidence climate indices of manufacturing, construction, service, and retail trade sectors. The current procedure adopted for the calculation of the IESI can determine discrepancies between the evolution of the composite index and the dynamics of the sector-level confidence climates. Although these discrepancies are explainable from a methodological point of view, they can create considerable problems in terms of interpretation and communication of the results. This work proposes a new method for calculating both the sectoral confidence climates and the IESI that ensures consistency in the evolution of the indicators and guarantees an effortless interpretation of the results

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Although this article is the result of all the authors' commitment, the paragraphs are attributed as following: 1, 6, 7 and 8 to Solange Leproux; 3, 4 and 5 to Adriano Pareto; 2 to Claudia Rinaldelli.

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1. Introduction

The Istat Economic Sentiment Indicator (IESI) is disseminated on a monthly basis with the Istat press release "Consumer and Business Confidence" starting from June 2012. It was conceived in 2011 when the direction of the business and consumer surveys, which are all part of a harmonised European programme coordinated by the European Commission[2], was passed from the Italian Institute of Economic Studies and Analyses (Isae) to the Italian National Institute of Statistics (Istat)[3].

This indicator was created with the aim of providing a composite measure of the state of the entire Italian production sector confidence, but over time it has also proved capable of providing coincident or even leading signals of our national economic cycle movements (Leproux and Matera, 2015).

The Istat produces a range of indices on sentiment in the Italian production sector. 11 series are available. These are currently aggregated into the IESI. As well there are four sectoral indices: the manufacturing confidence climate, the construction confidence climate, the market services confidence climate and, finally, the retail trade confidence climate. These use groups from the same 11 series. There are 3 each for manufacturing, market services, retail trade, and 2 in construction.

A difficulty that has been found is that movements in the aggregate index may not agree with the sectoral indices. For example, in May 2016, the IESI showed a slight increase (+0.7 percentage points) against a slight decrease in all the sector-based confidence climate indices. Later, in November 2019, the IESI again showed a slight increase (+0.2 percentage points) against a substantial stability in the retail trade and market service confidence indices and a slight reduction in the manufacturing and construction sector indices.

This does not seem satisfactory. As will be shown it occurs because the 11 series are modified in different ways when forming the sectoral indices to that when forming the aggregate index.

2 The programme is governed by the Decision of the European Commission C (97) 2241 of 15 July 1997 and by the Communication of the Commission COM (2006) of 12 July 2006.

3 The Isae suppression and the merger of the Institute with Istat were provided for by art. 7, paragraph 18, of the decree-law n. 78 of 2010, converted with amendments by law n. 122 of 2010.

In this paper a new IESI is computed that ensures that such a discrepancy does not happen. The construction of the new index preserves the essence of the existing methodologies. So it is a parsimonious[4] solution that gives an easy interpretation and communication of the state of confidence both at a sectoral and aggregate level. The results of the new IESI in terms of ability to capture fluctuations in the aggregate economic activity, are also presented. Finally, to complete the analysis, the performance tests in tracking the reference series are carried out using the current version of the indicator (current IESI).

The organisation of the work is as follows: Section 2 points at the criteria and the elaboration phases to be followed for the construction of a composite index in the existing methodological framework of the IESI; Section 3 shows the current calculation scheme. It describes in detail the present methodologies for the elaboration of both the sector-based confidence climates and the IESI index; Section 4 provides both the description and an example of the new methodologies proposed to replace the current ones; Section 5 presents a comparison between the new IESI and the current one in order to confirm the agreement between the results; Section 6 shows the results of the performance analysis carried out on the new versions of the indicator. For the sake of completeness, the same Section also reports the results obtained by subjecting the current version of the IESI to the same performance tests. Finally, Section 7 illustrates the authors' opinions on how much the effects of the COVID-19 pandemic play on the performance test results. Some conclusions are presented in Section 8.

4 The principle of parsimony states that the composite index must be as simple as possible, to allow easy interpretation of the results. See Mazziotta and Pareto (2020).

2. The revision of the Istat Economic Sentiment Indicator (IESI)

The IESI is part of a complex framework, because its methodology has always been discussed and partially guided by the Joint Harmonised EU BCS programme, and it has been disseminated for some years now.

This work on the IESI could not be configured as the ordinary construction of a composite indicator (as for other composite indicators already built in Istat), but rather as the corrective intervention of some phases of the current procedure, to avoid new inconsistencies, without however drastically intervening in a pre-existing methodological framework discussed at European level.

Therefore we tried to insert the criteria and the construction phases of a composite index in the existing methodological framework of the IESI. In particular, in order for the composite index to be as simple as possible and provide results consistent with the performance of the individual components, the processing to be carried out on the data must be reduced to the bare minimum[5].

Here these phases are summarised briefly (Mazziotta and Pareto, 2017; 2020):

1. *Defining the phenomenon to be measured*. The definition of the concept should give a clear sense of what is being measured by the composite index. It should refer to a theoretical framework, linking various sub-groups and underlying indicators. In this case, we aim to measure the state of confidence of the entire Italian productive sector, based on 4 sub-groups of confidence climate indicators of manufacturing, construction, services and retail trade sectors.
2. *Selecting a group of individual indicators*. The selection is generally based on theory, empirical analysis, pragmatism or intuitive appeal. Ideally, indicators should be selected according to their relevance, analytical soundness, timeliness, accessibility and so on. The selection phase is the result of a trade-off between possible redundancies caused by overlapping information and the risk of losing information. A group of 11 individual indicators of confidence climate were considered to calculate the IESI.

5 Only one normalisation method must be applied to the data matrix and no further transformation of the obtained scores should be carried out, as they are already normalised (Terzi *et al.*, 2021).

3. *Normalising the individual indicators*. This phase aims to make the indicators comparable. Normalisation is required before any data aggregation as the indicators in a data set often have different measurement units. Therefore, it is necessary to bring the indicators to the same standard, by transforming them into pure, dimensionless, numbers. Besides, since some indicators may be positively correlated with the phenomenon to be measured (positive polarity), whereas others may be negatively correlated with it (negative polarity), we have to transform the indicators so that an increase in the normalised indicators corresponds to increase in the composite index. The main normalisation methods are: standardisation (or z-scores), re-scaling (or Min-Max) and distance to a reference (or index numbers) (OECD and JRC, 2008). Standardisation and re-scaling are more commonly used when indicators have different measurement units and/or magnitude (*e.g.* GDP per capita and Life Expectancy); whereas index numbers are commonly used when indicators are of the same nature (*e.g.* prices or quantities). The new IESI is based on a normalisation of individual indicators by index numbers.
4. *Aggregating the normalised indicators*. It is the combination of all the components to form one or more composite indices. This phase requires the definition of the importance of each individual indicator (weighting system) and the identification of the technique (compensatory or non-compensatory)[6] for summarising the individual indicator values into a single number. Different aggregation methods can be used, such as additive methods (compensatory approach) or multiplicative methods and unbalance-adjusted functions (non-compensatory or partially compensatory approach). The methodological framework of the IESI is based on a compensatory approach and individual indicators are aggregated by a weighted arithmetic mean. The weighting system uses as weights the corresponding of Value Added as defined by National Accounts of each sector. Since March 2015, 2012 Value Added data are used.

6 Compensability among individual indicators is defined as the possibility of compensating any deficit in one dimension with a suitable surplus in another (OECD and JRC, 2008). Thus we can define an aggregation approach as 'compensatory' or 'non-compensatory' depending on whether it permits compensability or not (Casadio Tarabusi and Guarini, 2013).

5. *Validating the composite index*. Validation phase aims to assess the robustness of the composite index, in terms of capacity to produce a correct and stable measure, and its discriminant capacity (Influence Analysis and Robustness Analysis). A comparison of the new IESI with the current IESI and the Italian GDP was performed.

In the next Section, we show how the current IESI is calculated, whereas in Section 4 the new calculation scheme is described.

3. The current calculation scheme

The steps for calculating the current IESI and the confidence climate indicators of manufacturing, construction, services and retail trade sectors are the following. They were developed at different times by different teams.

3.1 Computing the confidence climate indicators

Let $\mathbf{X}^{k}_{n,m_k} = \{x^{k}_{j}\}$ be the matrix of seasonally adjusted balances of the climate k, where:

$$-100 \le x^{k}_{ij} \le 100$$

and x^{k}_{ij} is the balance value for month i (i=1, …, n) and variable j (j=1, …, m_k) of climate k (k=1, 2, 3, 4).

To have positive values, we move to the transformed matrix $\widetilde{\mathbf{X}}^{k}_{n,m_k} = \{\widetilde{x}^{k}_{ij}\}$, with: $\widetilde{x}^{k}_{ij} = x^{k}_{ij} + 100$, and then construct the matrix of the means $\overline{\mathbf{X}}_{n,4} = \{\overline{x}_{ik}\}$, where:

$$\overline{x}_{ik} = \frac{1}{m_k}\sum_{j=1}^{m_k}\widetilde{x}^{k}_{ij}$$

The 4 confidence climate indicators are given from the normalised matrix of index numbers with base 2010[7] $\mathbf{C}_{n,4} = \{c_{ik}\}$ where:

$$c_{ik} = \frac{\overline{x}_{ik}}{\frac{1}{12}\sum_{l\in 2010}\overline{x}_{lk}}100$$

Note that in this scheme the order of the phases 3 (normalisation) and 4 (aggregation) of Section 2 is not respected, as individual indicators are first aggregated into means, and then the means are transformed into index numbers.

7 The base update has been planned for 2024, subject to available data.

3.2 Computing the current IESI

Given the original matrix $\mathbf{X}^k_{n,m_k} = \{x^k_{ij}\}$, the normalised matrix of *z*-scores is constructed $\mathbf{Z}^k_{n,m_k} = \{z^k_j\}$, with:

$$z^k_{ij} = \frac{x^k_j - \mathrm{M}^k_j}{\mathrm{S}^k_j} \tag{3.1}$$

where M^k_j and S^k_j are respectively the mean and standard deviation of variable *j* of climate *k*.

Let $\mathbf{W}_4 = (w_1, w_2, w_3, w_4)$ be the array of the weights of the 4 confidence climates, with:

$$\sum_{k=1}^{4} w_k = 1 \qquad \text{and} \qquad 0 < w_k < 1 .$$

The weighted mean of the 11 normalised indicators is calculated as follows:

$$\overline{\mathrm{Z}}_i = \sum_{k=1}^{4} \frac{w_k}{m_k} \sum_{j=1}^{m_k} z^k_{ij}$$

and then it is normalised again by the formula:

$$\mathrm{Z}_i = \frac{\overline{\mathrm{Z}}_i - \mathrm{M}}{\mathrm{S}} 10 + 100$$

where M and S are respectively the mean and standard deviation of $\overline{\mathrm{Z}}$.

Finally, the IESI with base 2010, for month *i*, is given by:

$$\mathrm{IESI}_i = \frac{\mathrm{Z}_i}{\frac{1}{12}\sum_{l \in 2010} \mathrm{Z}_l} 100$$

There are a number of points of interest in this scheme. First, two different normalisation methods are used: standardisation (*i.e. z*-scores) and distance to a reference (*i.e.* index numbers). Standardisation is used twice, first for individual indicators and then for the weighted mean of standardised indicators; whereas distance to a reference is used for the standardised

weighted mean. However, index numbers describe percentage distances and computing percentage distances on *z*-scores does not make sense (Mazziotta and Pareto, 2021). Second, when a new month of data becomes available, the mean and standard deviation in formula (3.1) change, therefore standardised indicators must be recalculated for all series. Third, the current IESI cannot be computed as a weighted mean of the 4 confidence climate indicators, and this can cause inconsistent results. Last but not least, the calculation procedure is not based on the principle of parsimony.

4. The new calculation scheme

This *Section* describes, in detail, the new method for calculating the IESI and the confidence climate indicators, which allows the elimination of the current inconsistencies. The new IESI can be computed both as a weighted mean of the 4 confidence climate indicators and as a weighted mean of the index numbers of the 11 balances of the original variables, thereby obtaining a consistent result.

The calculation scheme is based on the guidelines of the literature which envisage a first step of normalisation of the individual indicators - the balances – by the distance to a reference method[8] and subsequent aggregations for the construction of partial indices or pillars - the 4 confidence climate indicators - and of the global index - the IESI (Aureli Cutillo, 1996; Salzman, 2003; OECD, 2008).

4.1 Computing the confidence climate indicators

Given the matrix of seasonally adjusted balances of the climate k $\mathbf{x}^k_{n,m_k} = \{x^k_{ij}\}$, we move to the transformed matrix $\widetilde{\mathbf{x}}^k_{n,m_k} = \{\widetilde{x}^k_{ij}\}$, with: $\widetilde{x}^k_{ij} = x^k_{ij} + 100$. Then, the normalised matrix of index numbers with base 2010 $\mathbf{Y}^k_{n,m_k} = \{y^k_{ij}\}$ is constructed, where:

$$y^k_{ij} = \frac{\widetilde{x}^k_{ij}}{\frac{1}{12}\sum_{l \in 2010} \widetilde{x}^k_{lj}} 100$$

and y^k_{ij} is the index number with base 2010 for month *i* and variable *j* of climate *k*.

Finally, the 4 confidence climate indicators are given from the matrix $\mathbf{C}_{n,4} = \{c_{ik}\}$, where:

$$c_{ik} = \frac{1}{m_k}\sum_{j=1}^{m_k} y^k_{ij}$$

4.2 Computing the new IESI

Let us consider the array of the weights of the 4 confidence climates $\mathbf{W}_4 = (w_1, w_2, w_3, w_4)$.

8 Note that the balances were not normalised by standardisation because they have the same nature and the same range.

The IESI with base 2010, for month *i*, can be obtained – as a function of the confidence climate – by the formula:

$$\text{IESI}_i = \sum_{k=1}^{4} c_{ik} \cdot w_k \tag{4.1}$$

or, alternatively – as a function of the index numbers of the 11 transformed balances of the original variables – by applying the formula:

$$\text{IESI}_i = \sum_{k=1}^{4} \frac{w_k}{m_k} \sum_{j=1}^{m_k} y_{ij}^k \tag{4.2}$$

4.3 An example of computation

This paragraph shows an example of computation of the 4 climates and the new IESI for the year 2010.

Table 4.1 illustrates the matrices $\mathbf{X}_{n,m_k}^k$ of seasonally adjusted balances of the 4 climates and Table 4.2 the matrices $\widetilde{\mathbf{X}}_{n,m_k}^k$ of the transformed (positive) values[9].

In Table 4.3 the matrices $\mathbf{Y}_{n,m_k}^k$ of index numbers with base 100 = 2010 are reported. In fact, the mean value of the index numbers, for the year 2010, is equal to 100. Lastly, Table 4.4 shows the matrix $\mathbf{C}_{n,4}$ of the 4 climates - with their weights based on 2012 Value Added data - and the IESI. As can be seen, the composite indices (partials and global) also have a base of 100 = 2010.

9 The variable labels are as follows. Retail trade: R_1=assessments on sales, R_2= assessments on stocks (negative polarity, the balance is taken with the sign reversed), R_3=expectations on sales. Services: S_1= assessments on orders and on demand in general, S_2=expectations on orders and on demand in general, S_3=assess$_m$ents on business trend. Construction: C_1=assessments on orders and/or construction plans, C_2=employment expectations. Manufacturing: M_1=assessment on stocks of finished products (negative polarity, the balance is taken with the sign reversed), M_2=assessment on the overall order books, M_3=expectations on production level.

Table 4.1 - Matrices of seasonally adjusted balances

Month	Retail trade			Services			Construction		Manufacturing		
	R_1	R_2	R_3	S_1	S_2	S_3	C_1	C_2	M_1	M_2	M_3
Jan-2010	8.4	2.5	14.2	1.2	7.1	0.7	-53.7	-19.4	3.5	-40.2	5.6
Feb-2010	-2.5	-3.1	8.8	1.8	15.2	4.7	-57.4	-28.7	3.0	-38.2	8.6
Mar-2010	-0.7	-0.2	19.5	-1.7	9.2	-2.2	-50.2	-21.8	3.1	-38.0	8.1
Apr-2010	0.6	-3.5	15.7	6.0	13.8	8.0	-49.1	-16.9	0.2	-30.9	10.3
May-2010	0.6	-7.2	15.5	0.9	10.5	3.7	-55.2	-23.2	3.1	-26.7	10.8
Jun-2010	-6.6	-7.0	13.9	-2.9	6.7	-0.3	-58.7	-12.0	4.5	-31.3	11.1
Jul-2010	-10.7	-11.3	12.9	-3.3	11.8	0.4	-56.8	-14.5	3.1	-23.1	10.9
Aug-2010	-3.6	-16.8	15.4	-0.5	8.6	0.2	-46.0	-9.1	0.5	-21.9	10.7
Sep-2010	-14.2	-8.4	10.8	-0.4	6.2	1.2	-45.6	-19.0	-0.4	-22.4	12.7
Oct-2010	-0.9	-8.0	16.2	-1.3	7.7	-0.6	-41.9	-19.3	-1.3	-18.4	13.7
Nov-2010	-5.9	-10.5	18.5	1.7	7.1	2.3	-40.6	-14.5	-1.4	-19.4	12.7
Dec-2010	12.6	-8.2	27.8	0.0	7.2	2.1	-46.3	-14.8	0.4	-14.3	14.1

Source: Authors' own processing

Table 4.2 - Matrices of transformed balances

Month	Retail trade			Services			Construction		Manufacturing		
	R_1	R_2	R_3	S_1	S_2	S_3	C_1	C_2	M_1	M_2	M_3
Jan-2010	108.4	102.5	114.2	101.2	107.1	100.7	46.3	80.6	103.5	59.8	105.6
Feb-2010	97.5	96.9	108.8	101.8	115.2	104.7	42.6	71.3	103.0	61.8	108.6
Mar-2010	99.3	99.8	119.5	98.3	109.2	97.8	49.8	78.2	103.1	62.0	108.1
Apr-2010	100.6	96.5	115.7	106.0	113.8	108.0	50.9	83.1	100.2	69.1	110.3
May-2010	100.6	92.8	115.5	100.9	110.5	103.7	44.8	76.8	103.1	73.3	110.8
Jun-2010	93.4	93.0	113.9	97.1	106.7	99.7	41.3	88.0	104.5	68.7	111.1
Jul-2010	89.3	88.7	112.9	96.7	111.8	100.4	43.2	85.5	103.1	76.9	110.9
Aug-2010	96.4	83.2	115.4	99.5	108.6	100.2	54.0	90.9	100.5	78.1	110.7
Sep-2010	85.8	91.6	110.8	99.6	106.2	101.2	54.4	81.0	99.6	77.6	112.7
Oct-2010	99.1	92.0	116.2	98.7	107.7	99.4	58.1	80.7	98.7	81.6	113.7
Nov-2010	94.1	89.5	118.5	101.7	107.1	102.3	59.4	85.5	98.6	80.6	112.7
Dec-2010	112.6	91.8	127.8	100.0	107.2	102.1	53.7	85.2	100.4	85.7	114.1

Source: Authors' own processing

Table 4.3 - Matrices of index numbers (base 100=2010)

Month	Retail trade			Services			Construction		Manufacturing		
	R_1	R_2	R_3	S_1	S_2	S_3	C_1	C_2	M_1	M_2	M_3
Jan-2010	110.5	110.0	98.6	101.1	98.0	99.0	92.8	98.0	101.9	82.0	95.3
Feb-2010	99.4	104.0	94.0	101.7	105.4	103.0	85.4	86.7	101.5	84.7	98.0
Mar-2010	101.2	107.1	103.2	98.2	99.9	96.2	99.8	95.1	101.6	85.0	97.6
Apr-2010	102.6	103.6	99.9	105.9	104.2	106.2	102.1	101.1	98.7	94.7	99.6
May-2010	102.6	99.6	99.8	100.8	101.1	102.0	89.8	93.4	101.6	100.5	100.0
Jun-2010	95.2	99.8	98.4	97.0	97.7	98.0	82.8	107.0	102.9	94.2	100.3
Jul-2010	91.0	95.2	97.5	96.6	102.3	98.7	86.6	104.0	101.6	105.4	100.1
Aug-2010	98.3	89.3	99.7	99.4	99.4	98.5	108.3	110.5	99.0	107.1	99.9
Sep-2010	87.5	98.3	95.7	99.5	97.2	99.5	109.1	98.5	98.1	106.4	101.7
Oct-2010	101.0	98.7	100.4	98.6	98.6	97.8	116.5	98.1	97.2	111.9	102.6
Nov-2010	95.9	96.0	102.4	101.6	98.0	100.6	119.1	104.0	97.1	110.5	101.7
Dec-2010	114.8	98.5	110.4	99.9	98.1	100.4	107.7	103.6	98.9	117.5	103.0
Mean	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: Authors' own processing

Table 4.4 - Matrix of the 4 climates and new IESI (base 100=2010)

Month	Retail trade (w=0,12)	Services (w=0,39)	Construction (w=0,09)	Manufacturing (w=0,40)	New IESI
Jan-2010	106.4	99.4	95.4	93.1	97.3
Feb-2010	99.1	103.4	86.1	94.7	97.9
Mar-2010	103.8	98.1	97.5	94.7	97.4
Apr-2010	102.0	105.4	101.6	97.7	101.6
May-2010	100.6	101.3	91.6	100.7	100.1
Jun-2010	97.8	97.6	94.9	99.1	98.0
Jul-2010	94.6	99.2	95.3	102.4	99.6
Aug-2010	95.7	99.1	109.4	102.0	100.8
Sep-2010	93.8	98.7	103.8	102.1	100.0
Oct-2010	100.0	98.3	107.3	103.9	101.6
Nov-2010	98.1	100.1	111.5	103.1	102.1
Dec-2010	107.9	99.5	105.6	106.5	103.8
Mean	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: Authors' own processing

5. Comparing the new and the current IESI

Table 5.1 shows the correlation coefficients and the mean absolute differences between the time series obtained with the new method and the current series, for the period January 2010 - December 2020 (131 observations), in order to assess the agreement between the results of the proposed method and the current one[10].

As for the trend of the time series, the correlations for the 4 climate indicators are all above 0.99; whereas the correlation between the new and the current IESI is equal to 0.9763. This value is slightly lower due to the inconsistencies present in the current computation method (for example, see Table 5.2).

Instead, as regards the 'distances' between the time series, the series that differs most from the current one is the construction climate (2.8%); whereas the mean absolute difference between the series of the new IESI and that of the current IESI is 4.2%.

The impact of the new computation method appears to be limited, considering that the time series of the balances are recalculated every month, through seasonal adjustment.

Finally, the reconstruction of the time series was carried out for the month of May 2016, a month in which the current IESI highlighted a misalignment between its trend and that of the confidence climate indicators. On that occasion, in fact, an increase in the IESI was observed (from 102.7 to 103.4, with a variation of +0.7), against a reduction in all 4 confidence climate indicators. This is due to the fact that, as explained in *Section* 3, two independent procedures are used for constructing the current IESI and the 4 climates. The 4 climates are computed as index numbers of a simple mean of seasonally adjusted balances plus 100 (transformed balances); whereas the current IESI is computed as an index number of a weighted mean of the 11 balances trasformed into *z*-scores.

10 The weights used to compute the current and the new IESI are the same (*i.e.* 2012 Value Added data).

Table 5.1 - Comparing the methods. Jan-2010 - Dec-2020 (base 100=2010)

Time series	
	Correlation coefficient
IESI	0.9763
Retail trade	0.9995
Services	0.9999
Construction	0.9979
Manufacturing	0.9973
	Mean absolute difference
IESI	4.2
Retail trade	0.3
Services	0.1
Construction	2.8
Manufacturing	1.3

Sourse: Autors' own processing

The results obtained with the two methods are shown in Table 5.2. As can be seen, the new IESI - thanks to the associative property of the arithmetic mean that allows it to be expressed both as a function of the 4 climates (formula 4.1), and as a function of the 11 transformed balances of the original variables (formula 4.2) - is consistent with the trend of the 4 confidence climate indicators. In this case, in fact, the index shows a decrease (from 107.0 to 106.7, with a variation of -0.3%), against the reduction of all climates. This decrease is equal to the weighted mean of the changes of the 4 climates.

Table 5.2 - Comparing the methods. May-2016 (base 100=2010)

Composite indicator	Apr-2016	May-2016	Percentage change
	Current method		
IESI	102.7	103.4	0.7
Retail trade	101.9	100.9	-1.0
Services	107.9	107.4	-0.5
Construction	121.2	120.4	-0.8
Manufacturing	102.7	102.1	-0.6
	New method		
IESI	107.0	106.7	-0.3
Retail trade	101.5	101.1	-0.4
Services	108.3	107.7	-0.6
Construction	122.9	122.7	-0.2
Manufacturing	103.9	103.8	-0.1

Sourse: Autors' own processing

6. The performance of the new IESI compared with the Italian GDP

Aggregate indices expressed as synthesis of the information provided by the monthly surveys on consumer and business confidence, represent a useful tool for monitoring the evolution of the aggregate economic activity, through their ability to provide coincident or even leading signals of the economic cycle movements.

The aim of this Section is to illustrate the results of the tests to which the new IESI -obtained following the methodological proposal explained in Section 4 - has been subjected to verify its specific characteristics in terms of ability to capture cyclical fluctuations of the national economic activity.

Although the session is mainly focussed on the new IESI, all the performance tests have also been extended to the current IESI[11]. This has been done simply to make the analysis more complete and not to conclude which indicator between the two is the best in terms of the ability to capture fluctuations in aggregate activity. In fact, this is not the purpose of this study.

The analysis was carried out using the sample period 2005Q2-2021Q3.

In this regard, it is important to highlight that the quarterly series of both the new IESI and the current IESI[12] have missing data for 2020Q2, since the Coronavirus health emergency meant that the Istat surveys for that date were not carried out[13].

Finally, in order to evaluate the information capacity of the indicators with respect to the cyclical evolution of the Italian economy, the analysis was conducted having chosen the Italian GDP series as the benchmark series[14].

Following Moore and Shiskin (1967), the behaviour of the two indicators,

11 For this analysis, both the new IESI and the current IESI were calculated using the data (the seasonally adjusted balances of the variables included in the index definition) published by Istat in February 2022. All the results of the Istat surveys on the business confidence climate are available for consultation in the Institute data warehouse I.STAT (web page: https://www.istat.it/it/dati-analisi-e-prodotti/banche-dati).

12 To facilitate the comparison with the reference series, the original monthly series of both indicators have been transformed into quarterly series. In particular, the average of the three months has been used for the transformation.

13 More specifically, in the original monthly series the missing data is that of April 2020. In this work the statistic and econometric tests were carried out having replaced it with the whole number immediately below the lowest value reached by each monthly series. In particular, t was evaluated to be 60.0 for the new IESI and 54.0 for the current IESI. In fact, the minimum values that the series reached were 60.4 and 54.2, respectively (in May 2020, in both cases). As a consequence, also the quarterly series of the two indicators have presented the lowest value in correspondence to the 2020Q2.

14 The seasonally adjusted series. Chain linked - reference year 2015. November 2021 edition.

with respect to the reference series, was evaluated by looking at the time consistency, the conformity and, finally, at the economic significance of the relationship existing between the series.

More specifically, the first analysis was carried out evaluating the time profile and the average lead/lag of the indicators for turning points in the reference series.

As for the identification of the turning points, both for the series of the indicators and for the one of the reference series, the Bry-Boschan procedure was used (Bry and Boschan, 1971)[15].

Following the growth cycle approach[16], the phases of expansion and recession of the reference series were identified after having removed the long-term trend from the Italian GDP series. This latter, in particular, was estimated using the Hodrick and Prescott (HP) filter in its standard version for quarterly series[17].

The classical NBER approach was adopted, instead, for the quarterly data of both the new IESI and the current IESI.

The second analysis was conducted calculating the directional coherence coefficients. They indicate the percentage of the times in which the new indicator and the current one move in the same direction as the chosen reference series[18] does.

Finally, the empirical relationship between the two indicators and the reference series was explored by resorting to both the cross-correlation test and the causality Granger test[19].

To start, Figure 6.1 shows the evolution of the new IESI indicator and of the

15 Specifically, the adaption of the Bry-Boschan procedure proposed by Harding and Pagan (2002).

16 Among the various methodologies for determining the turning points, the one based on the concept of growth cycle appeared to be the most appropriate given the stability characteristics of the economic growth path of our Country. Actually, following the approach of the cycle in growth rates, the analysis was conducted also using the Italian GDP transformed into the first differences of the logarithms. This allowed the identification of a higher number of turning points, but, as a whole, the results were considered less interesting for the purposes of the analysis.

17 Hodrick-Prescott (1997).

18 The Hodrick and Prescott detrended GDP series.

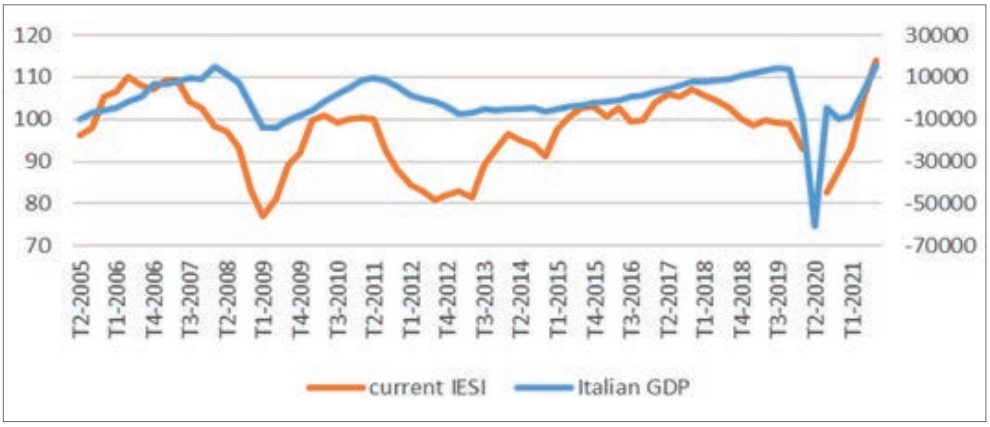
19 As for the reference series, these tests were performed having chosen the series of the Hodrick-Prescott detrended GDP, for the cross correlation analysis, and the one of the first differences of the GDP logarithm, for the Granger test, as will be set out below.

Italian GDP over the period 2005Q2-2021Q3. The similar pattern displayed by the two series leads one to think that the new indicator may have a quite good ability in tracking the Italian GDP. Besides, this relationship seems as close as the one that can be observed between the current IESI and the Italian GDP (Figure 6.2).

Figure 6.1 - New Istat Economic Sentiment Indicator (new IESI) and Italian GDP (a) - 2005Q2-2021Q3

Source: Authors' own processing
(a) GDP cyclical component obtained using the Hodrick and Prescott filter.

Figure 6.2 - Istat Economic Sentiment Indicator (current IESI) and Italian GDP (a) - 2005Q2-2021Q3



Source: Authors' own processing
(a) GDP cyclical component obtained using the Hodrick and Prescott filter.

As can be seen from a more careful examination of Figure 6.1, the new IESI series appears to anticipate the one of the HP filtered GDP in the first years of the sample period.

Furthermore, it seems to show higher volatility than the reference series used between 2013 and the end of 2017.

During the following two-year period (2018-2019), the indicators show opposite behaviours: the aggregate activity exhibits moderate growth, while the confidence indicator decreases.

Finally, in the last quarters of the period under observation, after the economic growth collapse caused by the COVID-19 pandemic in 2020Q2, both the variables rise again.

Looking now at the results reported in Table 6.1, in which the chronology identified by the Bry-Boschan procedure is reported, they display a good consistency with what emerged from the graphical inspection.

The lower dynamism of the Italian GDP series, particularly evident in the central years of the sample period, allows the procedure to identify for this series only two complete cycles from peak to peak. These latter appear characterised by a rather wide average length (23 quarters) because of the long central cycle 2011Q2-2019Q3.

Moreover, it is interesting to notice how the new IESI actually turns out to be able to track the reference series with a leading behaviour (-2.3 quarters, on average).

In particular, it appears coincident around the upturns, but decisively leading in correspondence to the downturn points (-4.7 quarters, on average).

As confirmation of what the graphical analysis highlighted, it anticipates the HP filtered GDP series in correspondence to both the peak present in the first part of the sample period (2008Q1) and the peak present at the end of the GDP moderate growth period (2019Q3).

As for the current IESI, it seems to track the reference series used even better than the indicator obtained by the new methodology. Initially, it shows some little variations which were not identified for the Italian GDP series and so the procedure located a higher number of complete cycles for this series (4).

Moreover, it anticipates the cyclical profile of the HP filtered GDP series of around four quarters on average (-3.7) with a lead in correspondence both of the upturn points (-1.3) and of the downturn points (-6.0).

Concerning the directional coherence analysis, a satisfactory result was obtained from the calculation of the related coefficient. In fact, as reported in Table 6.1, the new IESI appears to be able to correctly capture the sign of the reference variable in 68% of cases (the coefficient shows a value of 0.65 for the current IESI series).

At this point, as mentioned above, the empirical relationship between the indicators and the reference series was further verified resorting to the cross-correlation analysis and to the Granger causality test.

However, before proceeding with these tests, a preliminary study of the stochastic properties of the two indicators was carried out.

The results of this check showed that these series are stationary in the period 2005Q2-2021Q3. After all, these indicators are considered stationary by construction[20].

On the basis of this consideration, the time series of the two indicators were not subjected to any transformation.

Regarding the first test, the results of the cross correlation between the HP filtered GDP and the new IESI for the period 2005Q2-2021Q3 showed that the higher correlation coefficient between the two series was reached at time 0 (0.68)[21].

20 With reference to the presence of unit roots in series deemed to be stationary, see Brunello et al., 2000; Bruno, and Malgarini, 2002.

21 The 2-year moving correlation highlighted the empirical relationship between the HP filtered GDP and the indicator is particularly high in the two-year periods 2018Q2-2020Q2 (0.97) and 2009Q1-2011Q1 (0.93).

Table 6.1 - Turning point chronology and directional coherence (2005Q2-2021Q3)

Bry-Boschan Routine	Italian GDP	new IESI	current IESI
Number of cycles (from peak to peak)	2	3	4
Average duration (from peak to peak)	23.0	15.3	11.5
Average length of an expansion	17.0	7.7	5.0
Average length of a recession	5.0	8.3	7.2
Torning points			
Trough	/	/	/
Peak	2008Q1	2006Q2	2006Q2
Trough	2009Q2	2009Q1	2009Q1
Peak	2011Q2	2011Q2	2010Q2
Trough	2013Q1	2013Q2	2012Q3
Peak	/	2015Q3	2014Q1
Trough	/	/	2014Q4
Peak	/	/	2015Q4
Trough	/	2016Q3	2016Q3
Peak	2019Q3	2017Q4	2017Q4
Trough	2020Q2	2020Q2	2020Q2
Mean lead (-) /lag (+) at turning points (in quarters)			
Total	/	-2.3	-3.7
Upturns	/	0.0	-1.3
downturns	/	-4.7	-6.0
Directional coherence			
	/	0.68	0.65

Source: Authors' own processing

A similar result was obtained looking at the relationship between the reference series used and the current IESI. Also in this case, in fact, the maximum correlation coefficient (0.68) was reached at lag 0 (Table 6.2).

In the light of considerations pertaining to the adequacy of the regression model used, it was decided to make the next in sample forecasting exercise (the Granger causality test) using the first differences of the logarithms of the Italian GDP instead of the corresponding cyclical components[22].

22 Such a decision, in fact, allowed us to obtain the best results in terms of the regression model goodness. In the latter, in particular, having inserted up to 2 lags, all the parameters were statistically significant (0.000 the related probabilities), the R-squared was very high (0.83) and the F-statistic led to the clear rejection of the null hypothesis that the coefficients, except the intercept, are jointly equal to zero (0.000 the probability). Finally, using this model the residuals appeared homoscedastic and not serially correlated. On the contrary, both the Breusch-Pagan-Godfrey test and the White test led to the rejection of the null hypothesis of homoskedasticy of residuals when in the model the HP filtered GDP series, was introduced as the dependent variable. Moreover, on the basis of the LM test, the model was found to be characterised by serial correlated residuals. Lastly, the R-squared (0.51) and the adjusted R-squared (0.49) were lower than the ones of the model in which the first differences of logarithms of the Italian GDP was considered as the dependent variable (0.83, as reported above, and 0.82, respectively).

The results of the test showed that the lagged values of the new IESI (the independent variable of the regression model) did not improve the in-sample prediction of the Italian GDP values (Table 6.2). In fact, Granger's causality test led to the acceptance of the null hypothesis of no-Granger-causality between the new IESI and the reference series expressed in terms of the first differences of the logarithms (1.2, the value from the F statistic; 0.3 the value of the corresponding probability)[23].

To conclude, at the level of significance of 5% and of 10% also the current IESI seemed not to cause the Italian GDP (0.6 the related p-value of the F-statistic)[24].

Table 6.2 - Correlation function and Granger Causality test (2005Q2-2021Q3)

New IESI - Italian GDP (cyclical components)		New IESI - Italian GDP (first differences of logarithms)	
Correlation function		Granger Causality test (2 lags)	
ρ	0.68	F-Statistic	1.19
max	0	Probability	0.31
Current IESI - Italian GDP (cyclical components)		Current IESI - Italian GDP (first differences of log)	
Correlation function		Granger Causality test (2 lags)	
ρ	0.68	F-Statistic	0.45
max	0	Probability	0.64

Source: Authors' own processing

23 Having inserted up to 4 lags in the model, the F-statistic was 2.6 and the probability associated turned out to be just 0.05.
24 In this case, having inserted up to 4 lags in the model, the F-statistic was 1.6 and the probability associated 0.18.

7. A recent circumstance

According to the results, on the basis of which both indicators appear to not have any forecasting capabilities against the Italian GDP, some observations are really necessary regarding the latter two years due to the consequences of the COVID-19[25].

The values reported in Table 6.1 appear in fact so distant from those that would have been expected[26] to induce the authors to analyse the time series more closely considered in the regressive model.

In particular, it has been verified that the IESI series are stationary but a Granger causality test also requires that whatever GDP series is used as the dependent variable should be checked for stability of its moments across time.

Actually, the GDP series used[27] presents a serial correlation equal to 0.61 if the period 2005Q2-2019Q4 is considered, but equal to -0.24, if the entire sample period 2005Q2-2021Q3 is considered. This result (the negative correlation that the series presents in the entire period) shows how much these last two years have affected the series. The sudden changes in the state of the economy have introduced outliers in the Italian GDP series.

At this point, the data formation model of the series has changed and each of its values can no longer be partially explained by the data that precedes it, nor can it be indicative of the value that follows it.

This means that in the regression used for the investigation of causality in the Grangerian sense between the indicators and the Italian GDP, the results may be affected by the instability in the moments of the latter. Obviously, that makes the use of this model for the verification of the null hypothesis totally risky.

As proof of the weight that the anomalous data present in the last part of the Italian GDP time series had in determining the unexpected outcome of the tests, the cross-correlation and Granger's causality test were repeated taking into consideration the sub-period 2005Q2-2019Q4 (Table 7.1).

25 The authors thank an anonymous referee for having raised this point.

26 In fact, it is common opinion that the indicators of the business and consumer surveys, although subject to accidental cyclical fluctuations or other types of influences, are able to provide coincidental or even anticipatory signals of the cyclical fluctuations of the aggregate economy (Istat, 2022).

27 The Italian GDP series transformed into the first differences of the logarithms.

Table 7.1 - Correlation function and Granger Causality test (2005Q2-2019Q4)

New IESI - Italian GDP (cyclical components)		New IESI - Italian GDP (first differences of log)	
Correlation function		Granger Causality test (2 lags)	
ρ	0.64	F-Statistic	4.48
max	-2	Probability	0.02
Current IESI - Italian GDP (cyclical components)		Current IESI - Italian GDP (first differences of log)	
Correlation function		Granger Causality test (2 lags)	
ρ	0.68	F-Statistic	4.40
max	-2	Probability	0.02

Source: Authors' own processing

8. Concluding remarks

This paper proposes an alternative methodology for calculating the confidence climate indices that are monthly disseminated by the Istat. In particular, a new methodology has been proposed for the calculation both for the sectoral confidence indices (in detail, the manufacturing, construction, service and retail trade confidence climate index) and for the Istat Economic Sentiment Indicator (IESI).

This methodology ensures the consistency between the evolution of the composite indicator (IESI) and the dynamics of the sector-based indices. Consequently, it allows the overcoming of the possible discrepancies such as those that occurred in the past (in May 2016 and in November 2019).

In the new procedure, in fact, the normalisation of the seasonally adjusted variables composing the sectorial indices (more specifically, their transformation into 2010 indices) is the first phase of the sector-based climate index processing.

The new IESI obtained on the basis of this methodology, being a weighted average of the seasonally adjusted and standardised series composing the sector-level confidence climates, is necessarily consistent with the evolution of these indices.

After having illustrated in detail the current methodology and the new one, also providing an application example of the calculation scheme proposed, the work presents some empirical assessments.

First, the concordance between the results obtainable using the new methodology and the ones obtained following the current methodology has been verified. Subsequently, the new indicator performance, with respect to the cyclical trend of the Italian GDP, has been assessed.

As for the first verification, the results indicate that the new calculation scheme would produce the new series of the sectoral indices very similar to the ones obtained with the current procedure. Furthermore, it would generate the series of the new IESI consistent with the dynamic of the sectoral indices and, precisely for this reason, slightly different from the one of the current IESI.

As for the second one, the composite indicator, developed according to the new methodology, shows quite a good cyclical profile with respect to

GDP and seems capable of providing leading signals of the movements in the national economic cycle. Overall, it seems to have characteristics rather similar to the ones of the current IESI.

Nevertheless, the study highlight how much the period taken under observation (2005Q2-2021Q2) is difficult to analyse because of the COVID-19 pandemic effects on the macroeconomic variable trends. In fact, the well-known relationship between the confidence climate indicators and the GDP (in particular, their ability to provide coincidental or even anticipatory signals of the business cycle movements) is actually confirmed only when the sub-period 2005Q2-2019Q4 is considered. That is, only when the outliers determined by COVID-19 are not considered.

In light of the results obtained, we recommend changing the current methodology for calculating the IESI and the four sectoral indices with the new proposal.

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