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**Article**

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**ECONOMIC SENTIMENT PERCEPTIONS DURING COVID-19 PANDEMIC –  
A EUROPEAN CROSS-COUNTRY IMPACT ASSESSMENT**Iustina Alina Boitan<sup>1\*</sup>, Emilia Mioara Câmpeanu<sup>2</sup> and Sanja Sever Mališ<sup>3</sup><sup>1,2)</sup> Bucharest University of Economic Studies, Bucharest, Romania<sup>3)</sup> University of Zagreb, Zagreb, Croatia**Please cite this article as:**

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**Abstract**

An increasing body of recent literature focuses on how stock market investor sentiment fluctuates during the pandemic. However, a topic insufficiently addressed is related to investigating the changes occurred in the economic sentiment and expectations during COVID-19 pandemic, as a broader concept than stock market investors' perception and expectations. The paper investigates the impact of COVID-19 pandemic on the economic sentiment pattern in European Union countries, through two complementary research approaches: an exploratory data analysis technique represented by a hierarchic agglomerative clustering and a probabilistic GLM panel regression framework. Several official survey-based economic sentiment indices (Economic sentiment indicator, Employment expectations index, Composite leading indicator, Business confidence index, Consumer confidence index) are included in the empirical analysis to comprehensively reflect businesses and consumers' current economic and employment perceptions and expectations on future developments. The clustering solution indicates increased heterogeneity among European countries and no stable group. The sentiment related to the employment consequences of the COVID-19 crisis records the sharpest fluctuation and is reflected in countries' classification. The panel regression findings reveal that the number of new deaths is the most influential COVID-19 proxy variable, as it determines the evolution of most sentiment indicators.

**Keywords:** economic sentiment, confidence index, expectations, COVID-19 pandemic, cluster analysis, panel regression

**JEL Classification:** C23, C38, F63, M10, I19

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## **Introduction**

Despite its acknowledged importance, the issue of COVID-19 pandemic impact on the economic sentiment pattern in the European Union countries remains insufficiently explored in order to verify the presence of discrepancies between countries, and the determinants of economic sentiment dynamics by considering both households and business perceptions.

Our paper brings several novel contributions. First, we fill a literature gap by relying on several complementary official sentiment indicators that illustrate population and companies' perception on the economic development and prospects. These indicators, which have a complementary nature, are all computed by international authorities through large-scale surveys, in contrast to existing studies which address only a single indicator of economic sentiment or put emphasis on the investor sentiment during the pandemic.

The economic perception is a broader concept than stock market investors' perceptions and expectations because it encompasses issues related to economic growth and employment prospects, consumption, savings and investments. Sharp fluctuations in economic perception are a matter of interest for policymakers, as it is widely agreed that consumers and businesses' confidence in economic prospects are intrinsically linked to developments in the real economy (European Central Bank, 2019; Nowzohour and Stracca, 2020; van der Wielen and Barrios, 2020).

Second, the research aim is two-fold and shows: i) how European Union countries are grouped into homogenous clusters, according to changes in the economic sentiment indicators during the COVID-19 pandemic (a sign of synchronization of residents' perceptions); ii) the extent to which economic sentiment indicators are driven by the evolution of the pandemic. The third contribution is the inclusion in the empirical analysis of a comprehensive sample of EU member states, as opposed to existing studies addressing the issue in a single-country fashion. Another addition to existing literature refers to the period considered for the research which covers a longer time horizon related to both the onset and global spread of the pandemic. In this respect, it can be noticed that most existing studies focus on the first wave of the pandemic.

In addition, our paper alleviates a limitation identified by Teresiene et al., (2021, p. 15), which argue that "it would be appropriate to assess the impact of the COVID-19 pandemic on selected economic-sentiment indicators during different phases of the pandemic (onset of the pandemic, global spread, the second wave of the pandemic, beginning of vaccination, etc.)". Fourth, it is used a joint empirical approach, namely an exploratory learning method called cluster analysis, and a probabilistic approach represented by the panel regression. Fifth, a comprehensive array of six pandemic proxies is used to reveal which of them has the potential to trigger changes in the level of the various sentiment indicators.

The remainder of the paper is structured as follows: in section 1 we present an overview of the recently-related literature, section 2 describes the data used and the methodological approaches, section 3 summarizes and explains the findings while the last section concludes.

## 1. Review of the scientific literature

The COVID-19 pandemic exposes population and businesses to a new challenge that has shaken the way daily activities were carried-out. The economic consequences were unpredicted and expectations were biased inducing escalating uncertainty. Therefore, the economic sentiment across countries is witnessing an ongoing reshape.

Starting with the pandemic onset, the research topics recorded a change, to offer analytical and empirical support for accommodating new concerns. The impact of the coronavirus outbreak had become a top priority subject.

Increasingly more studies address the impact exerted by the COVID-19 pandemic on the financial markets, with concentrated on the effects triggered on investors' decision-making process, which are usually based on information coming from a relatively predictable environment. However, the COVID-19 crisis has brought a high degree of uncertainty that disrupts the decision-making process. Lyócsa et al. (2020) analyzed the 10 largest stock markets (USA, UK, Japan, France, India, Canada, Germany, Switzerland, South Korea and Australia) from 2 December 2019 to 30 April 2020 and demonstrated that stock markets' yields around the world have reacted to the fear of coronavirus. The results were based on 10 stock indices and on the volume of Google search for 19 keywords specific to the coronavirus crisis and government intervention policies meant to limit the adverse effects of the COVID-19 crisis.

The initial impact of the pandemic on US stock market returns, from the perspective of 11 indices provided by S&P Global and industry-wide returns is studied by Lee (2020) using Big Data for a period covering January 21 - May 20, 2020. The author offers investors information that determines the investment strategies at the level of their portfolios, given that there are differences at the level of industries. The results indicate that business sectors such as communications, consumer assistance, industry, energy and materials processing are sensitive to COVID-19 crisis information, while the real estate and utilities sectors are less affected. In addition, the impact of COVID-19 is unclear in the financial, information technology and health sectors.

A similar study on the effects of COVID-19 is conducted by Gherghina et al. (2020) at the level of the Romanian financial market, considering the time horizon 31 December 2019-20 April 2020. The research highlighted the absence of the impact of COVID-19 information from China on the financial market indicators in Romania, both in the short and long term, while data on deaths caused by COVID-19 in Italy produced an impact on the yield on Romanian bonds with a maturity of 10 years. Thus, the yield of 10-year Romanian government bonds reacts much more strongly to the news related to COVID-19 spread around the globe than the index of the Bucharest Stock Exchange.

Reis and Pinho (2020) looked at the association between the COVID-19 pandemic and the yields, volatility or volume of stock market transactions in the US and Europe to highlight the negative impact of the crisis on the rationality or irrationality of investors, as well as on stock market returns at countries and industries level. The authors relied on Google searches to build the perception index, which was later supplemented with regression analysis of data series (OLS) and panel data. Also, the attitude of investors towards risk, reflected through internet searches, has an important role in the volatility of stock markets especially in economically advanced countries (Amstad et al., 2020). At the same time, Altig et al. (2020) investigated the volatility of the US and UK stock markets both before

and during the COVID-19 pandemic, using press releases on public policy, Twitter discussions on economic developments, business uncertainty and macroeconomic fundamentals, as well as GDP forecasts. The results are in line with the aforementioned studies on the negative effects of the pandemic highlighted by significant volatility of variables especially in February-March 2020. Economic shocks due to uncertainty are estimated at 12-19%, amid reduced industrial production due to COVID-19.

The amplification of panic in the stock markets, caused by the acceleration of the number of COVID-19 infections, was much more intensely felt in the first part of the pandemic (the first 43 days) in the G-20 countries according to Singh et al. (2020), followed by the recovery period of the markets. The effects were felt at the level of stock market performance regardless of the level of development of the investigated countries. Regarding the Chinese economy, He et al. (2020) identified different reactions at industry level in terms of market performance amid the COVID-19 pandemic, namely: i) the negatively affected industries were transportation, mining, electricity, heating and environment; ii) industries not affected by the pandemic targeted the production activity, information technology, education and healthcare. The intensification of digitization is identified as a solution to counteract the negative effects of market sentiment due to the COVID-19 pandemic according to Ding et al. (2020), which analyzed 2000 NASDAQ-listed companies grouped into industries based on the MGI Industry Digitalization Framework.

Thus, by studying existing literature in this field, we identified a deficit of research papers focusing on the change occurred in the economic sentiment and expectations from the standpoint of businesses and regular people.

As far as our knowledge goes, a singular recent paper (Dreger and Gros, 2020) uses the economic sentiment indicator as a GDP proxy and correlates it with various social distancing measures. However, some papers tried to assess the economic perception of people, based on the frequency of Google or Twitter searches or newspaper-based measures (Chakraborty et al., 2020; van der Wielen and Barrios, 2020; Zhu et al., 2020; Garcia and Berton, 2021; Aguilar et al., 2020). This approach has some limitations because of the randomness and arbitrary choice of the key terms used for performing the search and computing the various newspaper/ search engine-based measures of economic uncertainty. There is wide variability of the chosen key terms, which is a major drawback as it makes it difficult to compare the results in a reliable and unbiased manner.

In terms of pandemic's economic impact, the literature review performed in this section highlights several approaches in terms of the variables used, the countries considered and research hypotheses tested.

Hongyuan et al. (2021) employ a cross-country investigation relying on an econometric model for 36 countries. Using monthly data (period December 2019 to October 2020), the authors explain the pessimism in terms of the economic sentiment after the lock-downs adopted as a consequence of the COVID-19 pandemic. Therefore, the pandemic has a negative incidence on the economic sentiment reflected by industrial confidence, while its effects on consumer confidence are positive. As regards the services sector confidence in future economic perspectives, the findings indicate no relationship.

During the COVID-19 pandemic it has been noticed a boost of economic anxiety, caused by the divergent beliefs of individuals (Fetzer et al., 2020). Forecasting the dynamics of economic anxiety in the pandemic period has practical implications because the

expectations and perceptions on the economy's evolution are influencing the decisions of individuals and businesses. The drivers of economic sentiment are investigated based on two surveys dedicated to the study of the economic anxiety in the case of US. The results reveal increased heterogeneity in individuals' beliefs which positively influence economic sentiment. The mortality risk impacts individuals' concerns related to its effects on the aggregate economy.

Another stream of literature focuses on the role of information in designing the economic sentiment and behavior (Kuchler and Zafar, 2019; Roth and Wohlfart, 2020). Other papers explain the incidence of the COVID-19 pandemic on EU financial markets and economic sentiment by using micro and macro approaches. There are differences among countries reactions to the pandemic especially in the economic sentiment of the construction sector (Kanapickiene et al., 2020).

Considering the existing scarce literature in this field, this paper questions two research hypotheses that are tested through different statistical methods: i) the homogeneity (resemblance) pattern of the economic perceptions reported by 19 European Union countries, and ii) the pandemic related-variables that exert a significant impact on the economic sentiment. The first hypothesis is based on the assumption that the EU countries should behave as a homogeneous group, as they have applied similar restrictive measures to counteract the effects of the COVID-19 pandemic. Therefore, as there has been the same exposure of the population and companies to restrictions in all European Union countries, their perceptions of economic recovery should be synchronized and harmonized. This hypothesis is investigated with the cluster analysis technique, because it allows us to identify the presence of a similarity pattern between countries.

The second research hypothesis investigates the assumption that all key information regarding the COVID-19 pandemic, in terms of variables officially published through reliable data sources, causes effects on economic sentiment from the point of view of both the population and companies. We test this aspect by a panel regression.

To verify the validity of the research hypotheses, the study relies on complementary research methods to deepen the understanding of the effects of the COVID-19 pandemic on economic sentiment, using variables and techniques that offer a more in-depth and comprehensive approach than the literature.

## **2. Data and research methodology**

### **2.1. Data**

Data for the five sentiment indicators meant to synthesize businesses and consumers' current perceptions and future expectations is collected from Eurostat and OECD database and covers the period January 2020 – October 2020. The variables used are as following: i) Economic Sentiment Indicator (ESI) and the Employment Expectations Index (EEI) which are published by the European Commission and Eurostat; and ii) the three confidence indicators computed and published by OECD, represented by the Composite leading indicator (CLI), the Business confidence index (BCI) and the Consumer confidence index (CCI). The COVID-19 proxy variables are obtained from the European Centre for Disease Prevention and Control. Data for population size and unemployment rate are taken from Eurostat. All the variables considered in the study exhibit a monthly frequency and are not

correlated. The complete list of the variables considered for the two-fold analysis is summarized in Table 1.

**Table no. 1. List of variables and data sources**

Variable name	Description	Source of data
<i>Dependent variables</i>		
Economic Sentiment Indicator (ESI, index)	a composite indicator that tracks GDP growth at EU member states levels, through surveys addressed to firms and to consumers. Values above 100 indicate above-average economic sentiment and vice versa.	Directorate General for Economic and Financial Affairs (DG ECFIN) of the European Commission, Eurostat
Employment Expectations Index (EEI, index)	indicates the employment expectations of managers in four surveyed business sectors (industry, services, retail trade and construction). Values greater than 100 indicate that managers' employment expectations are high by historical standards.	
Composite leading indicator (CLI, index)	reveals early signals of turning points in business cycles, fluctuations of the economic activity around its long-term potential level. It indicates short-term economic movements in qualitative rather than quantitative terms.	OECD
Business confidence index (BCI, index)	provides information on future business developments, based upon opinion surveys on developments in production, orders and stocks of finished goods in the industry sector. Values above 100 suggest an increased confidence in near future business performance.	OECD
Consumer confidence index (CCI, index)	indicates future developments of households' consumption and saving, based upon answers regarding their expected financial situation, their sentiment about the general economic situation, unemployment and capability of savings. A value above 100 signals a boost in the consumers' confidence towards their future economic situation.	OECD
population size (mil. inhabitants)	the size of a country, from a demographic standpoint	Eurostat
unemployment rate (% of the total population)	represents a proxy of the business cycle	Eurostat

Variable name	Description	Source of data
pandemic dummy	binary proxy for the occurrence of the pandemic, taking value 1 for the period starting with March 2020, and value 0, otherwise	the European Centre for Disease Prevention and Control
total number of new deaths (month-end)	confirmed new deaths, monthly cumulated value	
total number of new cases (month-end)	confirmed new cases, monthly cumulated value	
Deaths in confirmed cases (%)	% deaths among persons with laboratory confirmation of COVID-19 infection. It is a measure of the case fatality rate.	
total tests made (month-end)	indicates a country's capability to track the spread of the pandemic	
positivity rate (%)	the share of positive tests in total tests. It acts as a measure of how adequately countries are testing and helps understand the spread of the virus	

Table 2 summarizes the core descriptive statistics which bring additional evidence on the fluctuations recorded by each sentiment indicator since the pandemic outbreak. Standard deviation, in particular, shows that the highest heterogeneity among European countries appears in terms of employment expectations (11.78) and economic sentiment (12.74), the raw values being widely scattered around sample's mean. This preliminary conclusion on the characteristics of the input variables is supported by the values of the coefficient of variation, which suggests a high variability compared to the sample mean for the same two variables.

**Table no. 2. Descriptive statistics (January - October 2020)**

	Business confidence index	Consumer confidence index	Composite leading indicator	Employment Expectations Index	Economic sentiment indicator
<b>Mean</b>	98.73	100.14	97.58	98.52	94.20
<b>Median</b>	99.14	100.08	98.66	101.50	98.60
<b>Maximum</b>	102.11	103.49	100.98	116.50	116.50
<b>Minimum</b>	90.17	95.17	84.89	25.40	46.90
<b>Std. Dev.</b>	1.99	1.65	2.79	11.78	12.74
<b>Coefficient of variation</b>	0.02	0.02	0.03	0.12	0.14
<b>Skewness</b>	-1.25	-0.12	-1.64	-1.78	-1.22
<b>Kurtosis</b>	5.05	2.88	5.67	8.23	4.07

We mention that the following empirical analysis is directly constrained by data availability for all the variables used. Consequently, to perform the cluster analysis we consider only 19 countries (Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France,



Germany, Greece, Hungary, Ireland, Italy, Netherlands, Poland, Portugal, Slovak Republic, Slovenia, Spain, and Sweden), while for the panel regression we included 20 countries (all the above-mentioned ones and the UK).

## 2.2. Cluster analysis – methodological issues

The unsupervised exploratory analysis is conducted through a series of statistical algorithms also known as cluster or taxonomy analysis. The fundamental feature of this method resides in identifying existing patterns in an initial dataset and the further classification of countries into resembling/homogenous groups in terms of their features. These conclusions, in terms of homogeneity/similarity, are directly influenced by the specifics of the set of variables considered, being the result of applying a series of grouping algorithms and calculating similarity coefficients. As mentioned by Farnè and Vouldis (2017), the distinctive feature of clustering algorithms resides in their ability of identifying latent, hidden patterns into large amounts of data, by following the principle of “letting the data speak for themselves”.

Tiwari and Viñals (2012) argue that cluster analysis is a useful tool for decision makers because it allows them to identify vulnerable countries, especially since the economies of EU countries are interconnected and an adverse event or shock affecting a country can generate a contagion effect.

Fávero and Belfiore (2019) recommend using this method whenever one intends to verify the existence of similar behavior between entities (countries) in relation to given input variables, by creating smaller-size groups in which internal homogeneity prevails while being heterogeneous between them. Every group will symbolize the joint behavior of the observations belonging to certain variables.

This study performs a hierarchical agglomeration clustering to classify European Union countries into smaller, homogenous groups or clusters, based on five economic sentiment indicators which summarize people and businesses' perception on their current economic situation and their expectations about future developments. The indicators provide complementary information concerning various facets of economic activity in different sectors of an economy, such as: industry, services, construction, retail trade, as well as consumers and are not correlated. Two successive computational steps occur: (1) measuring the proximity or distance between individual countries by calculating a similarity coefficient called the Euclidean distance, and (2) measuring the proximity between groups of countries by using a linkage rule.

The Euclidean distance is used to measure the proximity between each pair of observations belonging to individual countries, with the general formula:

$$\text{Euclidean distance} = \sum_{i=1}^n (p_i - q_i) \quad (1)$$

where  $p_i$  and  $q_i$  ( $i = 1, \dots, n$ ) are two points in the Euclidean  $n$ -space which designate the values recorded by an input variable for pairs of individual countries. The intrinsic characteristics of the set of variables (categorical, continuous variables), as well as the method chosen to calculate the proximity between the groups of countries, have determined the choice of this type of distance.

Subsequently, the Ward linkage method computes the distance between groups of countries. Initially, each country is included in its own cluster and then the algorithm

performs successive iterations, at each stage joining the two most similar clusters, until there is just a single big cluster. At each stage the distances between clusters are recomputed according to Ward linkage clustering method. Literature in the field advocates for employing this method as a reliable and robust algorithm, as it is the only agglomerative clustering method applying the sum-of-squares criterion and the clusters generated are obtained by minimizing within-cluster contribution to the overall variance of a given variable, or alternatively by maximizing between-cluster contribution (Murtagh and Legendre, 2014; Irac and Lopez, 2015; Zhang and Gao, 2015). The general Ward formula for merging two clusters denoted A and B is:

$$\frac{nA \times nB}{nA + nB} (cA - cB)^2 \tag{2}$$

where  $nA$  and  $nB$  represent the number of countries in clusters A and B, and  $cA$  and  $cB$  are the centers of the two clusters.

The exploratory analysis is performed distinctly, at two moments of time: March 2020 to account for the state of optimism/confidence in the general economic climate at the beginning of the pandemic, and October 2020 for an updated picture related to the occurrence of the 2<sup>nd</sup> pandemic wave. Thus, the exploratory analysis focused on the moment of initial public awareness on the emergence and spread of a new highly contagious disease, and later on the moment that marks a new stage of growth of COVID-19 cases. Due to data availability issues, we considered a sample of only 19 European Union countries. As the variables have different means and standard deviations, the clustering methodology requires smoothing the presence of extreme values. Thus, each raw value is standardized by applying the z-score method: the mean of the overall sample is subtracted from each individual value, and then is divided by the standard deviation of the overall sample for a given variable. The outcome consists of a graphical hierarchical tree (dendrogram) synthesizing the order clusters are formed, their composition and distance between them. The longer the horizontal axis of the graph, the lower is the similarity between the groups of countries. Each cluster comprises those countries exhibiting specific but similar features in terms of the various sentiment indicators considered.

**2.3. Panel regression model**

The panel data sample contains a total of 200 monthly observations covering the period January 2020 - October 2020, for 19 European countries based on data availability for all the variables used in this research. By using a panel regression framework with a Generalized Linear Model and a Newey-West HAC approach for the covariance method, to handle estimated errors' heteroskedasticity and auto-correlation, we study the interplay between the evolving COVID-19 publicly available information and a set of representative sentiment indicators.

GLM type regression models propose a generalization of the classical linear regression models. Their specific element lies in modeling the statistical relationship between the dependent variable and the explanatory variables in the form of a link function, and the variance of each variable is a function of the predicted values (Zhao, 2013). For the configuration of the GLM model we considered the following components: i) the dependent variable has a normal distribution; ii) the systematic component is defined by the set of explanatory variables; iii) the connection function between the dependent variable and the

systematic component is of Identity type, because it allows the modeling of the average directly. The model thus generated is similar to a linear regression. The advantages of the GLM model consist in the creation of a comprehensive and unitary framework for modeling a data set that follows a probability distribution included in the exponential distribution family, such as normal, binomial, Poisson distribution, etc. (Khandelwal, 2019). In addition, unlike the linear regression model, the GLM model has the ability to model time series with continuous character, but also binary, categorical variables (Dobson and Barnett, 2018).

The general equation of the GLM regression is:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k, \quad (3)$$

Where:

$Y$  = dependent variable, represented by a set of five alternative variables to comprehensively capture the various perspectives of economic sentiment indicators

$\beta$  = estimated coefficients for each predictor (independent) variable

$X_1, X_2, \dots, X_k$  = set of independent variables, represented by control variables and pandemic-related variables

Complementary to this specification of the regression model, we applied the Panel Least Squares method and tested the validity of one of the following specifications: model without temporal or cross-section effects, model with fixed effects, respectively a model with random effects. The presence of fixed effects was verified with the Redundant Fixed Effects - Likelihood Ratio test, while the Hausman - Correlated Random Effects test was used for the random effects. The results generated by the two tests are inconclusive for the discrimination between the two types of effects, the only valid model being the one without effects. This model was retained to later serve as a test of the robustness of the estimates provided by the GLM panel model.

Each of the five sentiment indicators acts as an alternative dependent variable, while the list of explanatory variables comprises: i) a *COVID-19 dummy* to account for the specific impact triggered by the occurrence of the pandemic (takes value 1 for the period starting with March 2020 and value 0 otherwise); ii) several proxy variables to account for the evolution of the COVID-19 pandemic (*the total number of new monthly cases, the total number of monthly tests made, the positivity rate* computed as the ratio of positive tests in total tests, *% deaths in confirmed cases, total number of new monthly deaths*) and iii) three control variables. *Population* controls for the size of a country, from a demographic standpoint (Kiss, 2018), *the unemployment rate* controls for country's cyclical economic conditions (Becchetti et al., 2007; Kiss, 2018), while country's membership to euro zone is accounted for through a *dummy* taking value 1 for euro-zone members and 0 otherwise (Ioannou and Stracca, 2011).

The unemployment rate enters the regression with first-order lagged value, as its previous values help shaping consumers and businesses' contemporaneous perception/confidence towards the future economic situation. To address two potential sources of endogeneity, namely the issue of omitted variables and the simultaneity between the dependent and independent variables, we run a regression model with lagged regressor and we include a series of control variables. Our choice is in line with Barros et al. (2020), which explain

that using control variables is a preferential way of avoiding possible endogeneity problems in the empirical studies conducted for the financial field of research. All variables are seasonally adjusted, tested for unit root, while no significant correlation is found. To test the presence of the unit root, we applied a series of tests specific to panel data, such as the Levin, Lin & Chu test, the Im, Pesaran and Shin W-stat and ADF - Fisher Chi-square. Most variables are stationary in level, and the unemployment rate and the positivity rate are stationary in the first difference.

The statistical significance of the estimates generated by the GLM model was verified by two types of tests: i) the Ramsey Regression Specification Error Test (RESET) to assess the stability of the estimated parameters and detect potential specification errors (variables omitted from the analysis, incorrect functional form for variables used, etc.); ii) diagnostic tests on residuals. In this regard, we checked the histogram and the set of descriptive statistics of the residuals, focusing on Jarque-Bera statistics that indicate whether the errors are normally distributed. An additional test is Correlograms of Squared Residuals, which aims to indicate the presence of autocorrelation and partial autocorrelation at the level of the squared residuals.

### **3. Results and discussion**

The research results summarized in this section indicate the impact of the COVID-19 pandemic on the economic sentiment through a complementary and in-depth approach based on applying two statistical methods for testing the research hypotheses. We use cluster analysis to verify the first hypothesis concerning the similarity (homogeneity) among the selected European countries. The findings obtained have imposed a subsequent in-depth analysis, to understand the determinants for the lack of similarity between countries, because population and businesses in EU countries had to cope with the same restrictive measures. Therefore, we reveal the causes of the diverging patterns previously identified, by employing a set of key variables for reflecting the COVID-19 pandemic and by using a panel regression framework. The findings are detailed below.

#### **3.1. Cluster analysis results for the pandemic times**

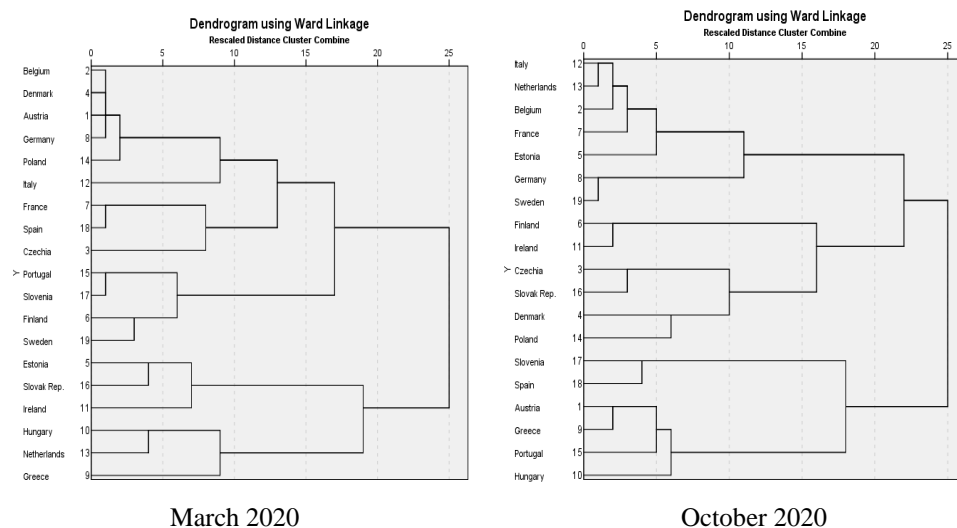
The COVID-19 pandemic imposed severe restrictive measures adopted by governments in the European countries. These were almost similar across countries, with differences regarding only the time moment of their implementation. If at the beginning of the pandemic the lock-downs have been a generalized measure implemented by governments, in the second wave of the pandemic (starting in the autumn of 2020) governments' responses to the containment of the pandemic spread were more diverse. Therefore, the two key moments of time (the onset of the pandemic and the second wave) are employed in this analysis to investigate the similarities in the economic sentiment and perceptions witnessed by European countries.

Consequently, we use cluster analysis based on data for the first pandemic wave (starting on March 2020) and respectively the second wave (October 2020), because each pandemic wave occurrence was accompanied by restrictive measures adopted by national decision-makers across EU countries.

The methodological framework of the cluster analysis provides flexibility in choosing the most appropriate cut-off distance, depending on the research aim. There is no optimal

minimum or maximum number of clusters to be generated; this number is exclusively driven by data intrinsic features. As previously mentioned, at different tree nodes, there is a merging process between similar groups till the final single cluster that reconciles all the countries. In order to interpret the solution obtained, the choice for the cut-off distance is made by the researcher. In practice, a large body of literature on various topics related to finance field uses the smallest distance range (of 0-5) for interpreting the clustering solution. It is also our case, as we aim at uncovering the specificities of European countries and reveal which are the closest peers (included hence in the same homogenous group). Additionally, we can state whether there is presence of heterogeneity or on the contrary, of homogeneity among countries given the five economic sentiment proxy variables.

Therefore, the clustering solution best describing the intrinsic informational content of the sentiment indicators dataset belongs to a distance interval of 0-5 (Figure no. 1). The hierarchical trees show the cluster each country had been assigned. The analysis reveals the presence of 10, and respectively 11 groups.



**Figure no. 1. Cluster analysis hierarchical tree (dendrogram) for the first wave (left side) and second wave of COVID-19 restraints (right side)**

In addition to the pattern of similarity between countries revealed by Figure no. 1, the baseline characteristics of countries included in each cluster, from the standpoint of people and businesses' expectations relative the future path of economic developments are explained in Table no. 3. The table summarizes dendrograms' clustering and makes use of primary descriptive statistics (sample's average, maximum and minimum sample's values) in order to reveal the individual features of each cluster.

A first finding consists in the large number of groups generated by the clustering algorithm, suggesting increased and persistent cross-country heterogeneity in terms of people and businesses' perception of the economic prospects and the presence of no stable groups of countries across the two time periods considered.

**Table no. 3. Clusters’ characteristics (March versus October 2020)**

List of identified clusters	Cluster characteristics	
	March 2020	October 2020
<b>Cluster 1</b>	slightly above-average value for CLI, CCI, BCI; below-average values for ESI and EEI	high values for CLI, CCI, BCI, above-avg. values for ESI; below-avg. values for EEI
<b>Cluster 2</b>	below-avg. values for CLI, CCI, EEI; slightly above-avg. for BCI; the lowest value for ESI	above-average values for CLI, CCI, ESI and below-average values for BCI and EEI
<b>Cluster 3</b>	below-average values for CLI, CCI and EEI; above-average values for BCI and ESI	the highest values for CLI, CCI, BCI and ESI and above-average values for EEI
<b>Cluster 4</b>	the smallest value for CLI, one of the highest values for CCI, below-average values for BCI, ESI, EEI	one of the highest values for CLI, slightly above-avg. values for CCI, below-avg. values for BCI and ESI, one of the lowest EEI levels
<b>Cluster 5</b>	above-average values for CLI and ESI, below-average values for CCI and BCI, one of the highest values for EEI	below-average values for CLI and ESI, above-average values for CCI and BCI, close to sample's average values for EEI
<b>Cluster 6</b>	above-average values for CLI, below-average for CCI and ESI, close to average values for BCI and EEI	above-average values for CLI, high values for BCI and CCI, below-average values for ESI and the lowest sample's value for EEI
<b>Cluster 7</b>	above-average values for CLI and ESI, below-average for BCI, the highest values for CCI, close to average values for EEI	above-average values for CLI and EEI, slightly below-average values for CCI and BCI and the smallest sample's value for ESI
<b>Cluster 8</b>	above-average values for CLI, CCI, below-average for BCI and ESI, the lowest value for EEI	the lowest values for CLI, CCI, one of the highest levels for BCI, above-average levels for ESI and EEI
<b>Cluster 9</b>	above-average values for CLI, CCI, BCI, ESI and EEI	slightly above-average values for CLI, CCI, BCI and ESI; the highest values for EEI
<b>Cluster 10</b>	the highest value for CLI, BCI, ESI and EEI; one of the highest values for CCI	below-avg. values for CLI, CCI, BCI; slightly above-avg. values for ESI; high value for EEI
<b>Cluster 11</b>	-	below-average values for CLI, BCI, ESI; one of the highest sample's values for CCI, EEI

In March 2020, Greece is the best positioned country, with the highest values for all the five sentiment indicators, meanwhile Hungary and Netherlands exhibit above-average values for all sentiment indicators. At the opposite are Italy and Czech Republic with 4 out of 5 sentiment indicators below sample's average, suggesting a state of low confidence and pessimism related to future economic climate. The remaining countries record close or above-average levels for most sentiment indicators.

In October 2020, Germany and Sweden are the best positioned countries due to the highest values for 4 indicators and above-average values for EEI, followed by Austria and Greece which exhibit above-average values for all sentiment indicators. All other countries show mixed evidence, with both above and below-average values for the various economic sentiment indicators.

The variables ESI and EEI are contributing most to the diverging patterns across countries. They record most below-average values for both October and March 2020. Hence, they signal a persistent concern on the evolution of business activity in several economic fields (industry, services, construction, retail trade and consumption), as well as on the employment expectations. Our finding is in line with the one reported by Wielen and Barrios (2020) which perform an analysis based on Google Trends data and document a substantial worsening in people's economic sentiment following the pandemic outbreak as well as a significant, coinciding slowdown in labor markets.

### 3.2. Panel regression results

The findings based on cluster analysis highlight the low resemblance tendency among the 19 European countries, as a consequence of the biased economic perception of population and businesses. Therefore, the panel regression brings new insights and reveals those key variables related to the COVID-19 pandemic which have the potential to shape the economic sentiment through public and businesses perceptions.

The empirical findings summarized in Table no. 4 confirm that changes in the economic sentiment (proxy by five alternative dependent variables) are determined by COVID-19 related-indicators.

**Table no. 4. Model specifications and results**

	<b>Model 1 (CLI is the dependent variable)</b>	<b>Model 2 (CCI is the dependent variable)</b>	<b>Model 3 (BCI is the dependent variable)</b>	<b>Model 4 (ESI is the dependent variable)</b>	<b>Model 5 (EEI is the dependent variable)</b>
<b>Population size</b>	0.53*** (0.33)	0.29*** (0.17)	0.72** (0.29)	4.76* (1.16)	6.24* (2.23)
<b>Unemployment rate</b>	0.29 (0.44)	-0.07 (0.22)	-0.37 (0.28)	-1.78 (1.23)	-0.91 (1.88)
<b>Euro-zone dummy</b>	0.06 (0.75)	-0.84** (0.33)	-0.25 (0.504)	5.64** (2.65)	3.22 (3.58)
<b>% Deaths in confirmed cases</b>	-0.07 (0.04)	-0.028 (0.025)	0.03 (0.026)	0.16 (0.18)	-0.11 (0.304)
<b>COVID-19 dum.</b>	82.12* (5.703)	96.71* (3.12)	82.84* (4.45)	19.16 (12.15)	16.51 (28.92)
<b>Total number of monthly deaths</b>	-1.07* (0.31)	-0.14 (0.13)	-0.75* (0.207)	-6.93* (0.99)	-5.02* (1.59)
<b>Total number of monthly cases</b>	0.34 (0.43)	0.0008 (0.19)	0.82* (0.29)	6.27* (1.55)	1.69 (1.79)
<b>Total monthly tests made</b>	0.60** (0.302)	-0.104 (0.15)	-0.08 (0.24)	-3.45* (1.067)	-2.06 (1.68)
<b>Positivity rate</b>	0.02 (0.016)	0.0002 (0.005)	0.01 (0.009)	0.08 (0.05)	0.14** (0.056)

*Note: \*, \*\*, \*\*\* indicate statistical significance at the 1%, 5%, and 10% level, respectively. Standard deviations are presented in brackets. Population size, total number of new monthly deaths, total number of new monthly cases and total monthly tests made enter the regression in natural logarithm, because it is a very convenient and robust method of expressing very large numerical values and their fluctuations can be better modeled if they are expressed as a logarithm.*

The six variables specific to the pandemic context enter the regression in current values and not with time lag, in order to capture the contemporary impact exerted on the indicators of economic sentiment.

The number of new deaths is the most influential COVID-19 proxy variable as it negatively impacts four out of five sentiment indicators. An increase of this variable fuels pessimistic perceptions and expectations about business cycle and employability prospects. Analyzing comparatively the values of the estimated coefficients, it can be observed that the greatest impact is exerted on the two indicators calculated and monitored by the European Commission (-6.93, respectively -5.02). Our finding is in line with the one reported by Baek et al. (2020) which uncover that negative news regarding the number of deaths is twice as impactful as positive news regarding recoveries for the US stock market volatility.

The occurrence of the pandemic, symbolized by the COVID-19 pandemic dummy, is positive and highly statistically significant for the three OECD confidence indicators. This finding suggests that businesses and consumers in OECD countries are more confident and optimistic in the path of the economic recovery as they trust the fiscal and economic measures adopted by national governments during the pandemic, a feature of better institutional environment compared with other European countries. Similar positive relation is noticed by Chiah and Zhong (2020) which argue that during the pandemic, when extreme sentiment and disagreement occurs, investors intensify the equity trading on stock markets.

The contemporaneous increase in the number of new cases determines a positive and statistically significant dynamics only for those sentiment indicators related to future developments within various sectors of economic activity. This result can be explained by businesses' self-fulfilling hope that after reaching the pandemic peak, it will follow a downward slope marking the pandemic end which coincides with business recovery. An alternative explanation lies in the fact that the spillover of the impact on economic sentiment indicators is not immediate, but a process of accumulation over time is needed to determine a significant effect on the expectations of the population and companies.

Another important finding points out that, apart from the number of new deaths, the statistical relationship exhibited between pandemic-related proxies and sentiment indicators incorporates the subjective optimistic belief that pandemic's final containment is close, despite the broad-scale, global uncertainty about its duration and severity. Our results complement the official opinion (OECD, 2020) that expanding countries' capacity of testing, tracking and tracing new cases shapes the evolution of the pandemic, with direct and immediate effects on economic environment.

The indicator on employment expectations among company managers is negatively influenced by the increase in the mortality rate, but positively by the increase in the positivity rate. This variable, which helps at understanding the degree of the virus spread among the population, determines a state of optimism among employers.

The dummy variable that reflects the status of a euro area member country is not statistically significant in 3 of the 5 models tested, which suggests that joining the euro area is not relevant to explain the dynamics of the dependent variables. This result is similar to that obtained by Ioannou and Stracca (2011).

For robustness check, a new GLM panel regression analysis is run by using as dependent variable another survey-based indicator provided by Eurostat, namely the Financial sector



confidence. The indicator gathers in a single metric the economic perception of entities operating in the EU financial services sector regarding their past 3-month evolution and next 3-month expectations in terms of business situation, demand for financial services and employment. The findings confirm again the statistically significant impact of 4 out of 6 pandemic-related proxies (Table no. 5).

**Table no. 5. Robustness test – GLM model**

	Financial sector confidence (dependent variable)
Population size	1.88 (2,21)
Unemployment rate	-2.22 (2.61)
Euro-zone dummy	5.69 (4.77)
% Deaths in confirmed cases	-0.18 (0.48)
COVID-19 dummy	-89.71* (30.74)
Total number of monthly deaths	-8.89* (2.74)
Total number of monthly cases	7.21* (2.65)
Total monthly tests made	1.32 (2.36)
Positivity rate	0.28* (0.07)

Note: \*, \*\*, \*\*\* indicate statistical significance at the 1%, 5%, and 10% level, respectively. Standard deviations are presented in brackets.

Additionally, we completed the series of robustness tests by applying a Panel Least Squares model, keeping the same configuration of the set of dependent and explanatory variables as in the GLM model. The new results are summarized in Table no. 6. The estimates, in terms of statistical significance of the explanatory variables and sign associated with the coefficients, are similar with those generated by the GLM model initially tested.

**Table no. 6. Robustness test - Panel Least Squares model**

	Model 1 (CLI dep. var.)	Model 2 (CCI dep. var.)	Model 3 (BCI dep. var.)	Model 4 (ESI dep. var.)	Model 5 (EEI dep. var.)
Population size	0.33 (0.35)	0.34** (0.17)	0.66** (0.26)	5.403* (1.08)	7.35* (1.79)
Unemployment rate	0.22 (0.47)	-0.07 (0.25)	-0.38 (0.33)	-1.92 (1.45)	-0.94 (1.77)
Euro-zone dummy	-0.19 (0.40)	-0.87* (0.21)	-0.37 (0.29)	5.25* (1.52)	3.66*** (2.203)
% Deaths in confirmed cases	-0.05 (0.05)	-0.023 (0.033)	0.047** (0.022)	0.27** (0.13)	0.018 (0.23)
COVID-19 dummy	84.18* (4.91)	96.11* (2.17)	83.77* (2.99)	16.18 (10.54)	12.76 (22.14)
Total number	-0.86**	-0.16	-0.69*	-6.66*	-4.86*

<b>of monthly deaths</b>	(0.33)	(0.18)	(0.18)	(0.86)	(1.36)
<b>Total number of monthly cases</b>	0.24 (0.41)	0.014 (0.203)	0.89* (0.22)	6.31* (1.15)	1.96 (1.55)
<b>Total monthly tests made</b>	0.71** (0.29)	-0.12 (0.15)	-0.13 (0.21)	-4.11* (1.104)	-3.39** (1.37)
<b>Positivity rate</b>	0.028* (0.01)	0.0017 (0.005)	0.012 (0.006)***	0.12* (0.03)	0.19* (0.048)

*Note: \*, \*\*, \*\*\* indicate statistical significance at the 1%, 5%, and 10% level, respectively. Standard deviations are presented in brackets.*

The results indicate that the variable total number of deaths (monthly average) keeps its high statistical significance, and it negatively affects four out of five indicators of economic sentiment. At the same time, the positivity rate determines four out of five indicators.

The dummy variable COVID-19 maintains its power of determination for the three confidence indicators calculated by the OECD, being statistically insignificant for the indicators of economic sentiment and employment expectations calculated by Eurostat.

A country's ability to monitor the spread of the pandemic, reflected in the variable total number of tests performed, has a statistically positive and significant impact on the composite indicator of changes in the short-term economic cycle. In contrast, increasing a country's testing capacity, as a variable contemporaneous with the evolution of dependent variables, does not lead to an improvement in the public perception on growth prospects and future employment expectations in EU member states.

**Conclusions**

This paper subscribes to the strand of literature that emphasizes, from a theoretical and empirical standpoint, the key role played by economic-sentiment indicators in revealing an economy's overall health, growth and future trends. Despite their importance in acting as a fundamental driving force of the economy, because consumers' and businesses' optimistic consumption and investment behaviour are further fuelling the economic growth (Teresiene et al., 2021), there is a lack of comprehensive studies that assess how the spread of the COVID-19 pandemic is affecting these economic-sentiment indicators. In a similar fashion, Baker et al. (2020) outline the need for in-depth analyses, because the economic constraints generated by the pandemic have undoubtedly brought more tension to the economy and at the same time have adversely impacted the confidence of households and businesses.

Consequently, the paper explores the fluctuation of economic sentiment indicators' during the COVID-19 pandemic for a sample of 19 European Union countries through two complementary research directions. The clustering findings show an increased number of clusters identified in both periods (first and second wave) considered. Also, results indicate wide fragmentation and heterogeneity between European countries in terms of perceptions and expectations for current and future economic climate. There is no single stable group of countries among the two time periods, signaling that businesses and consumers' sentiment fluctuates independently across countries, being mostly determined by their trust in national measures and strategies adopted for the containment of the pandemic and its economic and

social effects. Therefore, the same exposure of both population and businesses to similar restrictions across EU countries tackles different patterns of reactions in terms of economic sentiment to the COVID-19 pandemic.

The panel analysis reveals that COVID-19 proxies are an important metric for estimating the amplitude of the change recorded by various survey-based sentiment indicators. Notably, the results show that awareness of witnessing pandemic times (accounted for by the COVID-19 dummy) and an upward number of new deaths are more impactful on businesses and consumers' confidence and expectations than other pandemic proxies.

The limits of the research are the availability of data for all EU member states and the variety of government measures taken at different times, depending on the domestic evolution of the COVID-19 pandemic.

Future research directions include extending the analysis period to include both the three-wave pandemic period and the relaxation period followed by the imminence of the fourth wave. Thus, it is possible to investigate whether there are fluctuations in the impact of the pandemic on economic sentiment indicators, along the four waves, and to what extent the reopening of businesses and the economy restore market optimism.

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