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The Impact of the COVID-19 Pandemic on Consumer and Business Confidence Indicators

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Abstract: The COVID-19 pandemic and induced economic and social constraints have significantly impacted the confidence of both consumers and businesses. Despite that, comprehensive studies of the impact of the COVID-19 pandemic on the consumer and business sentiment are still lacking. Thus, in our research we aim to identify consumer and business confidence indicators' reaction to the spread of the COVID-19 pandemic in the Eurozone, the United States, and China. For this purpose, we used the method of correlation–regression analysis. We chose the consumer-confidence index, manufacturing purchasing manager's index, and services purchasing manager's index as dependent variables; and the number of confirmed cases of COVID-19, the number of deaths caused by COVID-19, and the mortality rate of COVID-19 infections as independent variables. The results showed a relatively rapid and robust effect of COVID-19 in the short period, but longer-term results depended on the region and were not so unambiguous: in the case of the Eurozone, the spread of COVID-19 pandemic did not affect the consumer-confidence index (CCI) or, in the cases of the United States and China, affected this index negatively; the purchasing managers' index (PMI) in the services sector was significantly negatively affected by the mortality risk of COVID-19 infection; and the impact on the purchasing managers' index (PMI) in the manufacturing industry appeared to be mixed.

Keywords: COVID-19 pandemic; economic sentiment; consumer confidence; leading indicators

1. Introduction

The COVID-19 pandemic has been a big shock for the global economy, but this crisis is different from other types of situations—especially a financial or banking crisis. The main difference is the level of impact and the causes of the problem. Consumer confidence and economic sentiment are the critical drivers for future economic growth. The health crisis of the COVID-19 pandemic and lockdowns had a significant impact on society. Those changes can be seen in consumer and business confidence indicators. Thus, it is essential to analyze how this demand and business sentiment changed in the COVID-19 environment to better analyze the possible consequences in the future.

The economic consequences of the COVID-19 pandemic, as well as its impact on the general economy and consumer and business sentiment, were analyzed by van der Wielen and Barrios (2020), Coibion et al. (2020), Andersen et al. (2020), Barro et al. (2020), and Chronopoulos et al. (2020).

As stated by van der Wielen and Barrios (2020), the COVID-19 crisis and crisis-induced constraints drastically affected households' economic sentiment in Europe. Negative trends in consumption and the labor market emerged.

Andersen et al. (2020) analyzed customer spending changes and indicated a spending drop that was larger in the sectors of goods and services directly affected by COVID-19 pandemic-induced restrictions.

Baker et al. (2020) analyzed the indicators of newspaper-based economic uncertainty and subjective uncertainty in business-expectation surveys, and indicated an unprecedented decrease of these measures in the face of the COVID-19 pandemic.

Although research on the impact of the COVID-19 pandemic on economic sentiment has become more widespread recently, most of the studies have focused on one area (consumer sentiment or business sentiment), or one region or country (the United States, the United Kingdom, Europe, etc.). Our research is not only focused on the analysis of the impact on different sentiment indicators (both consumer and business), but also includes the analysis and comparison of several regions.

Some authors analyzed the sentiment of economics or consumers on a country level, while others focused on a regional level. Savin and Winker (2011) analyzed Germany and Russia's cases, and pointed to the specifics of tendencies in different countries. Bhattacharyay et al. (2009) studied early-warning indicators impacting economic and financial risks in Kazakhstan. Kanapickiene et al. (2020) found that at the beginning of the COVID-19 crisis, there were different reactions in separate European countries. However, for more extended periods (i.e., covering both the onset of the pandemic in China and its global spread (the first and the second waves)), there is a lack of studies. With our research, we add value to the literature covering the COVID-19 pandemic impact. We use a longer time horizon and attempt to identify the differences in consumer and business sentiments in different regions. Armantier et al. (2020) analyzed the impact of the COVID-19 pandemic on consumer confidence in the United States. They tried to identify how the pandemic's impact had changed over time and among different demographic groups.

There is a large group of authors that have analyzed leading indicators as tools for predicting economic tendencies in the future, especially during recession periods Cesaroni and Iezzi (2015), Döpke (1999), Dovern and Ziegler (2008), Döpke (1998), Oh and Waldman (2005), Lysenko and Kolesnichenko (2016), Lehmann (2020), Drechsel and Scheufele (2010), Kibritcioglu et al. (1999), Alleyne et al. (2013), Frale et al. (2009), Ferrara and Marsilli (2012), Etter and Graff (2003), Drechsel and Scheufele (2011), Dovern (2006), Garnitz et al. (2019), Buckman et al. (2020), Baker et al. (2020), Aguilar et al. (2020), Fritsche and Kouzine (2002), Ampudia et al. (2020), Juriova (2015), and Kitrar and Lipkind (2020); or used leading indicators for financial stability issues, especially for financial monitoring purposes (Bhattacharyay 2003). At the same time, other authors have focused on the problematic and main drivers that influence and have the most significant impact on leading indicators (Hüfner and Lahl 2003); or analyzed the main idea and construction of leading indicators Everhart and Duval-Hernández (2000), Elosegui et al. (2008), Bierbaumer-Polly (2010), Kellstedt et al. (2015), Martha Starr (2008), and Martinakova and Kapounek (2013).

Considering that, this paper's primary purpose is to assess the impact of the spread of the COVID-19 pandemic on consumer and business sentiment in different regions.

We aim to identify consumer and business confidence indicators' reaction to the COVID-19 pandemic in the Eurozone, the United States, and China. For this purpose, we chose the consumer confidence index as well as the purchase manager's indices for manufacturing and services.

After analyzing the relevant scientific literature, we continue with the description of the research methodology (provided in Section 2) and the presentation of our results (provided in Section 3).

To assess the impact of the COVID-19 pandemic, we chose to analyze economic sentiment in three different regions: the Eurozone, the United States, and China. For each area, we selected three different economic sentiment indicators: (i) consumer confidence index, (ii) purchase manager's index in the manufacturing sector, and (iii) purchasing manager's index in the services sector.

2. Literature Review

As stated by Nowzohour and Stracca (2017), "Sentiment may be used to describe economic agents' views of future economic developments that may influence the economy because they influence agents' decisions today". The economic sentiment includes two opposing dimensions—confidence and uncertainty (van der Wielen and Barrios 2020). The COVID-19 pandemic and social and economic constraints induced by this pandemic have undoubtedly brought more tension to the economy (Baker et al. 2020), while at the same time affecting the confidence of households and businesses. As economic-sentiment indicators are one of the most critical indicators showing the economy's overall health, it is crucial to assess how the spread of the COVID-19 pandemic affects those indicators. Our analysis contributes to the theoretical issues analyzing how consumer and business sentiments can change in periods of external shocks. Consumer confidence is often described as a fundamental driving force of the economy, because when consumers are optimistic, consumption increases, and we have economic growth; while in pessimistic periods, consumers pull down the economy.

Sentiment issues are significant in analyzing economic growth and tendencies in financial markets, and especially when trying to identify future trends. The sentiment of financial markets, consumers, and business entities can be measured by various surveys, after which different sentiment indices are created based on the responses to specific questions about current and expected economic conditions. These indices are used for forecasting household expenditures, consumer spending habits, tendencies in the labor market, or even industrial production growth. However, some authors have an opinion that sentiment surveys have little power for predictions (Roberts and Simon 2001).

Not only are quantitative indices used in the forecasting process, but qualitative assessment of textual sentiment in news is becoming more and more popular. Ardia et al. (2019) found that news-based sentiment values help increase the accuracy of forecasting methods trying to identify the growth rates of industrial production in the United States. So, sentiment can be measured by using various survey quantitative indicators and including qualitative information such as news.

Understanding the sentiment itself is also very important. When trying to describe the concept of sentiment, scientists usually use such proxies such as fear and uncertainty. Barone-Adesi et al. (2018) revealed that sentiment and fear are complementary risk-aversion measures that are linked with uncertainty.

Sentiment indicators are a part of leading indicators that are used to predict future financial and economic trends, as those indicators change before factual changes in economy or business. Leading indicators are not new phenomena and include not only economic, business, or consumer sentiment indicators. Different indicators are essential and have been analyzed for various purposes. Leading inflation indicators are necessary for the monetary policy decision-making process. Ripatti (1995) investigated the mentioned inflation indicators by using Finland's case and applying a pairwise analysis of Granger causality and cointegration. We even found news-sentiment indicators created using digital technology such as machine learning (Nguyen and La Cava 2020; Lee et al. 2012). Some authors (Gurcihan et al. 2013) studied leading indicators for unemployment rate forecasting. Gründler and Potrafke (2020) pointed out an exciting moment when experts

changed their policy decisions because of sentiment analysis. Burri and Kaufmann (2020) created a leading indicator using financial market and news data.

Benhabib and Spiegel (2017) investigated how sentiment or consumer-confidence shocks can influence state outputs and consumptions, and they revealed a significant effect during a one-year horizon. The impact of consumer sentiment on consumption was analyzed by Gillitzer and Prasad (2016). Golinelli and Parigi (2004) investigated consumer sentiment and economic activity and, using a large set of observations, confirmed the consumer-confidence indices' forecasting ability in the sample and out-of-sample periods.

National sentiment and economic behavior can be crucial in the sports field of trying to bet on final match results (Braun and Kvasnicka 2013). Sentiments have strong power in any area. Charoenrook (2005) analyzed the University of Michigan Consumer Sentiment Index and found that consumer-sentiment changes were positively related to contemporaneous excess market returns, and that they were negatively related to future excess market returns at different horizons. The author pointed out that a shift in consumer sentiment can improve asset-return predictions. Consumer-confidence issues were also analyzed in the research of Daas and Puts (2014), who investigated country-level social-media messages and compared them with consumer confidence. Using the Granger causality test, the mentioned authors revealed that "changes in consumer confidence precede those in social media sentiment than vice versa" (Daas and Puts 2014). Fuhrer (1993) paid a lot of attention to consumer-sentiment analysis and tried to identify the role of consumer sentiment in the Unites States' macroeconomy. The author stressed that "consumer sentiment, or consumer confidence, is both an economic concept and a set of statistical measures" (Fuhrer 1993). Consumer confidence as a household-sentiment indicator can help to explain tendencies in the consumer-loans segment (Rakovská et al. 2020).

Asset-return predictions are modeled not only using consumer-confidence indicators, but also including investor-sentiment indices. Chen et al. (2013) used a principal-component approach and constructed an investor-sentiment index for the Chinese stock market and found that the created index had good out-of-sample predictability. Investor-sentiment issues were analyzed in the studies of Chu et al. (2015). The authors revealed that economic variables could increase forecasting accuracy when investor sentiment was low, and lose their prediction power when investor sentiment was high. Another author (Dieckelmann 2021) used corporate-bond and stock-market data as proxies for investor-sentiment measurement, and used those proxies not only for forecasting tendencies in the financial market, but also for predicting banking crises and economic cycles. The role of market sentiment is very important for forecasting tendencies in the financial market, and a study (Frydman et al. 2019) showed that market sentiment was not related to the state of the economy. Investor sentiment was also analyzed by Jiang et al. (2020), García et al. (2019), Nartea et al. (2019), Jiang et al. (2020), Tuyon et al. (2016), and Uygur and Taş (2014).

While consumer-confidence analysis is much broader, there is still a lack of literature analyzing business sentiment. There are business-sentiment indicators for different sectors explaining the mood of separate parts of the economy. These business-sentiment indices mostly are based on a survey about present and future tendencies. As those indicators include information about the future, they can be used for forecasting as well. Vanhaelen et al. (2000) investigated the Belgian industrial-confidence indicator and tried to answer whether this country-level sentiment indicator precedes euro-area business cycles. The authors concluded that the turning points in the Belgian industrial confidence indicator significantly impact turning points in the euro area. Using graphical examination, correlation analysis, and Granger causality tests, Santero and Westerlund (1996) revealed that business-sentiment measures gave valuable information when trying to assess the present economic situation and to forecast future economic trends. Kukuvec and Oberhofer (2018) analyzed EU business-sentiment indicators and found substantial spillover effects.

We agree that all sentiment indicators are more focused on the expectations about the future. A present economic situation has a very short impact, so such kind of indicators help in future trend predictions. It is essential to analyze how sentiment indicators interact

with each other, especially in such critical moments as the COVID-19 pandemic. In our paper, we attempt to add value to the literature analyzing sentiment issues during critical moments and shocks, and at the same time, we want to stress regional aspects, as the COVID-19 pandemic is global.

3. Methodology

Seeking to evaluate the impact of the spread of the COVID-19 pandemic on economic sentiment, the economic-sentiment indicators of three different regions—the Eurozone, the United States, and China—were selected for further investigation. As we aim to analyze the reaction of both consumers and businesses to the COVID-19 pandemic, three different economic sentiment indicators—the consumer-confidence index (CCI), and the purchase manager's indices for manufacturing and services (manufacturing PMI and services PMI, respectively) were selected.

Our research consisted of two stages. In Stage 1, the trends of the selected economic sentiment indicators (indices) were analyzed (Section 4.1). Afterward, in Stage 2, the impact of the COVID-19 pandemic on the sentiment of both consumers and businesses was assessed (Section 4.2).

In Stage 1, we used the method of graphical and statistical analysis and analysis of the trends of consumer and business confidence indicators in the face of the COVID-19 pandemic. We also used the method of correlation analysis (Pearson correlation coefficient) in order to identify possible similarities or differences between the dynamics of the selected economic-sentiment indicators in different regions.

In Stage 2, the impact of the spread of the COVID-19 pandemic on selected consumer and business confidence indicators was assessed.

When assessing the economic impact of the COVID-19 pandemic, many researchers (Verma et al. 2021; Chen et al. 2020; Lee 2020; Pavlyshenko 2020; Vasiljeva et al. 2020; Fetzer et al. 2020; Kanapickiene et al. 2020; Albulescu 2020; Ashraf 2020, and others) used the regression approach. For example, Verma et al. (2021) used the method of correlation–regression analysis in order to assess how COVID-19 was correlated with economic growth, and evaluated the impact on stock markets. Ashraf (2020) used panel-data regression models to assess the impact of COVID-19 on stock-market returns. Pavlyshenko (2020) discussed different regression approaches for modeling COVID-19's impact on the stock market. Albulescu (2020) used simple OLS regression to evaluate the impact of COVID-19-induced uncertainty on the volatility of financial markets. Fetzer et al. (2020) also used the regression technique in order to assess the relationship between the spread of COVID-19 and economic anxiety. Chen et al. (2020) provided the regression models of high-frequency indicators allowing the assessment of the economic impact of COVID-19. Lee (2020) conducted a correlation–regression analysis to explore the initial impact of COVID-19 sentiment.

Given the wide application of the regression techniques in COVID-19-induced economic-impact studies, in our research, we used the methods of correlation and regression to assess the impact of the spread of the COVID-19 pandemic on selected economic-sentiment indicators.

First of all, at the starting point of the assessment, seeking to identify a possible linear association between selected consumer and business sentiment indicators and COVID-19 related variables, the correlation was assessed (the Pearson correlation coefficient was calculated and interpreted). Second, the simple linear (bivariate) regression models for each pair of dependent and independent variables were constructed. Considering the statistical characteristics of these models (t-value, p-statistics, R squared), the conclusions regarding the impact of the spread of the COVID-19 on consumer and business economic sentiment were made. It is important to note that in our research, we were not able to construct multiple regression models due to: (i) a relatively small number of observations, and (ii) multicollinearity of regressors.

For this research, we selected the following nine dependent variables: (i) Eurozone CCI, (ii) Eurozone manufacturing PMI, (iii) Eurozone services PMI, (iv) United States CCI, (v) United States PMI, (vi) United States services PMI, (vii) China CCI, (viii) China PMI, (ix) and China services PMI.

Based on previous studies (for example, Albulescu 2020, Ashraf 2020, Verma et al. 2021, and others), we selected five groups of COVID-19-related variables: (i) the cumulative number of cases of COVID-19 confirmed in each region selected and globally, (ii) new cases of COVID-19 confirmed in each region selected and globally per month, (iii) cumulative number of deaths from COVID-19 reported in each region selected and globally, (iv) new deaths from COVID-19 reported each region and globally per month, and (v) COVID-19 fatality rate in each region and globally. By choosing these groups of variables, we intended to check: (i) whether confidence was affected by the total prevalence of COVID-19 or its monthly growth, (ii) whether consumers and businesses tended to react to the increase of COVID-19 cases or its caused deaths, (iii) whether the changes of the fatality rate of COVID-19 affected confidence indicators, and (iv) whether the reaction to country-level and global-level changes differed.

Based on this logic, 20 independent COVID-19-related variables were chosen for our research. Research variables (dependent and independent), their abbreviations, and data sources are provided in Table 1.

Table 1. Research variables and abbreviations.

Variable		
Name	**Full Name**	**Source**
Dependent variables:		
CCI Eurozone	Eurozone Consumer Confidence Indicator	Thomson Reuters
PMI Manuf. Eurozone	Eurozone Purchasing Manager Index of the manufacturing sector	
PMI Serv. Eurozone	Eurozone Purchasing Manager Index of the services sector	
CCI United States	United States Consumer Confidence Indicator	
PMI Manuf. United States	United States Purchasing Manager Index of the manufacturing sector	
PMI Serv. United States	United States Purchasing Manager Index of the services sector	
CCI China	China Consumer Confidence Indicator	
PMI Manuf. China	China Purchasing Manager Index of the manufacturing sector	
PMI Serv. China	China Purchasing Manager Index of the services sector	
Independent variables:		
Total cases Eurozone	Cumulative number of cases of COVID-19 confirmed in the Eurozone	World Health Organization Coronavirus disease 2019 (COVID-19) situation reports.
New cases Eurozone	New cases of COVID-19 confirmed in the Eurozone per month	
Total deaths Eurozone	Cumulative number of deaths from COVID-19 reported in the Eurozone	
New deaths Eurozone	New deaths from COVID-19 reported in the Eurozone per month	
Total cases United States	Cumulative number of cases of COVID-19 confirmed in the United States	
New cases United States	New cases of COVID-19 confirmed in the United States per month	
Total deaths United States	Cumulative number of deaths from COVID-19 reported in the United States	
New deaths United States	New deaths from COVID-19 reported in the United States per month	
Total cases China	Cumulative number of cases of COVID-19 confirmed in China	
New cases China	New cases of COVID-19 confirmed in China	
Total deaths China	Cumulative number of deaths from COVID-19 reported in China	
New deaths China	New deaths from COVID-19 reported in China per month	
Total cases World	Cumulative number of cases of COVID-19 confirmed globally	
New cases World	New cases of COVID-19 confirmed globally per month	
Total deaths World	Cumulative number of deaths from COVID-19 reported globally	
New deaths World	New deaths from COVID-19 reported globally	
Fatality rate Eurozone	COVID-19 fatality rate in the Eurozone	Our World in Data Coronavirus Pandemic (COVID-19) (Roser et al. 2020) database
Fatality rate United States	COVID-19 fatality rate in the United States	
Fatality rate China	COVID-19 fatality rate in China	
Fatality rate Worlds	COVID-19 fatality rate globally	

Source: compiled by the authors.

In our research, we analyzed the period of January 2020 to January 2021 and used monthly data (as the data of selected economic-sentiment indicators is provided on a monthly basis). The data of the selected economic-sentiment indicators were retrieved from

Thompson Reuters database, and the data for COVID-19-related variables were collected from World Health Organization coronavirus disease 2019 (COVID-19) situation reports and the Our World in Data Coronavirus Pandemic (COVID-19) (Roser et al. 2020) database (see Table 1). Data were analyzed using Eviews 11 software.

It is important to emphasize that we did not seek to analyze a comprehensive set of economic-sentiment factors in our research. We only aimed to identify the presence or absence of the reaction to the COVID-19 pandemic (and its direction).

The descriptive statistics of selected dependent (economic sentiment (CCI, manufacturing PMI, services PMI)) and independent (COVID-19-related) variables are provided in Table 2. The dynamics of COVID-19 related variables are shown in Appendices A–D.

Table 2. Summary of descriptive statistics of models variables.

Variable	Mean	Median	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis	Obs.
CCI Eurozone	−14.508	−14.7	−6.6	−22.7	4.185	0.144	3.121	13
PMI Manuf. Eurozone	49.046	51.7	55.2	33.4	6.618	−1.187	3.471	13
PMI Serv. Eurozone	42.762	46.9	54.7	12	12.433	−1.392	3.907	13
CCI United States	100.6154	96.1	131.6	84.8	16.433	1.000	2.551	13
PMI Manuf. United States	53.008	54.2	60.7	41.5	5.961	−0.642	2.441	13
PMI Serv. United States	54.677	56.9	58.7	41.8	5.198	−1.692	4.401	13
CCI China	119.517	119.7	126.4	112.6	3.976	0.013	2.169	12
PMI Manuf. China	51.131	51.5	54.9	40.3	3.601	−2.196	7.543	13
PMI Serv. China	51.146	54.1	58.4	26.5	8.760	−1.892	5.862	13
Total cases Eurozone	4,871,279	1,451,245	19,633,934	13	6,539,193	1.301	3.204	13
New cases Eurozone	1,510,303	475,381	5,226,912	13	1,906,455	0.905	2.102	13
Total deaths Eurozone	161,534.8	136,136	471,122	0	137,704.6	0.961	3.243	13
New deaths Eurozone	36,240.15	21,913	103,184	0	41,068.39	0.743	1.816	13
Fatality rate Eurozone	6.075	6.1	10.9	2.2	3.618	0.157	1.357	12
Total cases United States	7,123,187	4,566,931	26,187,035	8	8,265,678	1.205	3.324	13
New cases United States	2,014,387	1,206,239	6,406,683	8	2,218,935	1.121	2.779	13
Total deaths United States	166,079.7	154,545	448,100	0	137,801.6	0.528	2.501	13
New deaths United States	34,469.23	26,593	95,371	0	29,443.6	0.794	2.713	13
Fatality rate United States	3.958333	3	10.3	1.7	2.506	1.439	4.342	12
Total cases China	82,517.85	87,655	100,063	9802	22,597.5	−2.809	9.733	13
New cases China	7697.154	2259	69,554	190	18,749.2	3.083	10.707	13
Total deaths China	4113.769	4661	4817	213	1326.33	−2.221	6.884	13
New deaths China	370.5385	35	2624	0	771.336	2.254	6.827	13
Fatality rate China	4.807692	5.2	5.5	2.2	0.941	−1.833	5.547	13
Total cases World	30,310,546	17,604,278	1.03×10^8	9927	34,227,637	0.973	2.672	13
New cases World	7,857,240	7,146,442	19,445,486	9927	7,141,688	0.554	1.907	13
Total deaths World	803,218.4	675,905	2,234,722	213	719,483.6	0.609	2.297	13
New deaths World	171,901.7	167,373	409,144	213	121,859.7	0.394	2.597	13
Fatality rate World	3.707692	3.3	7.2	2.1	1.643	0.882	2.603	13

Source: authors' calculations based on Thomson Reuters, WHO World Health Organization (2020), and the Our World in Data Coronavirus Pandemic (COVID-19) (Roser et al. 2020) database. Note: Obs. = observations.

4. Results and Discussion

This section analyzes the dynamics of the selected economic-sentiment indicators in the Eurozone, United States, and China. The effect of the COVID-19 pandemic on different sectors' economic-sentiment indicators in three regions was assessed.

4.1. Analysis of the Trends of Economic Sentiment Indicators in the Face of the COVID-19 Pandemic

The Eurozone dynamics and the United States' and China's CCI, manufacturing PMI, and services PMI are provided in Figure 1.

Figure 1. Dynamics of CCI (**a**), and manufacturing (**b**) and services (**c**) PMI, in the Eurozone, the United States, and China (January 2020–January 2021). Source: compiled by the authors based on Thomson Reuters data. Note: M1 = January, M2 = February, M3 = March, M4 = April, M5 = May, M6 = June, M7 = July, M8 = August, M9 = September, M10 = October, M11 = November, M12 = December. For CCIEZt, PMIMEZt, PMISEZt, CCIUSt, PMIMUSt, PMISUSt, CCICHt, PMIMCHt, and PMISCZt, see Table 1.

From Figure 1, we can observe several essential trends of consumer confidence in the face of the COVID-19 pandemic:

(i) The Eurozone CCI, being on average the lowest of all the regions analyzed (mean—14.508), demonstrated much lower volatility (st. deviation—4.185) than the United States index (st. deviation—16.433), and only slightly higher volatility than the China index (st. deviation—3.796); the lowest value of CCI was observed in April 2020

(Figure 1a), which practically coincided with the first peak of new cases and deaths of COVID-19 (Appendix A);

(ii) Being the highest in January 2020 (before the spread of pandemic), the United States CCI experienced the sharpest decline in comparison with other analyzed regions and demonstrated much higher volatility; the lowest values were observed in May 2020 and August 2020 (Figure 1a), which also coincided with the first and the second peaks of COVID-19 pandemic (Appendix B);

(iii) The China CCI demonstrated the lowest volatility in the face of the COVID-19 pandemic and was on average the highest of all regions analyzed (mean—119.517) (Figure 1a).

In terms of business sentiment in the manufacturing and services sectors, the data in Figure 1 allowed us to assume that in the face of the COVID-19 pandemic:

(i) Both manufacturing PMI and services PMI were on average the lowest in the Eurozone (the means were 49.046 and 42.762, respectively), and experienced the sharpest decline in comparison with the same indices in the other analyzed regions (Figure 1b,c);

(ii) During the first peak of the pandemic, business sentiment in the services sector declined more than business sentiment in the Eurozone and China's manufacturing sector. However, this was not the case in the United States;

(iii) In the cases of the Eurozone and the United States, the lowest values for the business-sentiment indicators were observed in April 2020; while in the case of China, the lowest values were observed in February 2020, which coincided with the peak of new cases and deaths in the country (Appendix C);

(iv) The lowest volatility of business sentiment in the manufacturing and services sector (st. deviation—3.601 and 8.760, respectively) was observed in the United States.

To investigate possible differences in the response of consumer- and business-confidence indicators to the spread of the COVID-19 pandemic, we also assessed the interrelationship between these indicators in different regions. The results of a correlation analysis (Appendix E) of the Eurozone, the United States, and China economic-sentiment indicators inter alia showed a strong or robust correlation between PMI (both manufacturing and services sectors) in the Eurozone and the United States, a substantial correlation between CCI in the Eurozone and the United States, and moderate negative correlation between the China PMI in the services sector and the United States CCI.

Further, it was analyzed how the spread of the COVID-19 pandemic was related to recent changes in consumer- and business-confidence indicators.

4.2. Assessment of the Impact of the Spread of COVID-19 Pandemic on Consumer and Business Sentiment

First, the correlation between economic sentiment and COVID-19 related indicators was assessed. The results of the correlation analysis are provided in Table 3.

The results of the correlation analysis (Table 3) showed that:

(i) The Eurozone consumer-confidence index was not correlated with any COVID-19 variables, while CCI in the United States was strongly negatively correlated with total cases of the COVID-19 pandemic confirmed globally, and CCI in China was strongly negatively correlated with COVID-19 fatality rate both in China and globally;

(ii) Interestingly, in all analyzed regions, business sentiment in the manufacturing sector strongly positively correlated with the global spread of COVID-19 (cases and deaths); while at the same time, the United States manufacturing PMI positively correlated with, while the China manufacturing PMI negatively correlated with, country-level COVID-19 indicators; and the Eurozone and the United States manufacturing PMIs negatively correlated with COVID-19 fatality rate both in at the country and global levels;

(iii) As with manufacturing PMI, the Eurozone and the United States services PMIs were negatively correlated with the COVID-19 fatality rate at the global level; while in

China, the services PMI was positively correlated with the global spread of COVID-19 and negatively correlated with country-level COVID-19 indicators.

Table 3. Correlation of selected economic sentiment variables and COVID-19-related variables.

Variable	Correlation	Probability	Correlation	Probability	Correlation	Probability
	CCI Eurozone		PMI Manuf. Eurozone		PMI Serv. Eurozone	
Total cases Eurozone	−0.105	0.744	0.567	0.054	0.192	0.550
New cases Eurozone	−0.179	0.577	0.573	0.052	0.129	0.689
Total deaths Eurozone	−0.255	0.423	0.519	0.084	0.200	0.534
New deaths Eurozone	−0.417	0.178	0.087	0.788	−0.330	0.294
Fatality rate Eurozone	−0.469	0.124	−0.737	0.006 **	−0.434	0.159
Total cases World	−0.087	0.788	0.679	0.015 *	0.308	0.331
New cases World	−0.161	0.617	0.705	0.011 *	0.337	0.285
Total deaths World	−0.154	0.633	0.697	0.012 *	0.352	0.262
New deaths World	−0.427	0.166	0.411	0.184	0.082	0.800
Fatality rate World	−0.443	0.150	−0.974	0.000 **	−0.760	0.004 **
	CCI United States		PMI Manuf. United States		PMI Serv. United States	
Total cases United States	−0.093	0.774	0.730	0.007 **	0.449	0.143
New cases United States	0.232	0.469	0.678	0.015 *	0.368	0.239
Total deaths United States	−0.404	0.193	0.754	0.005 **	0.456	0.136
New deaths United States	−0.450	0.142	0.230	0.472	−0.112	0.729
Fatality rate United States	−0.548	0.065	−0.658	0.019 *	−0.347	0.269
Total cases World	−0.690	0.013*	0.769	0.003 **	0.469	0.123
New cases World	0.474	0.119	0.805	0.002 **	0.471	0.122
Total deaths World	−0.386	0.216	0.789	0.002 **	0.483	0.112
New deaths World	−0.458	0.134	0.553	0.062	0.193	0.548
Fatality rate World	−0.482	0.113	−0.944	0.000 **	−0.864	0.000 **
	CCI China		PMI Manuf. China		PMI Serv. China	
Total cases China	−0.450	0.142	0.166	0.607	0.129	0.689
New cases China	0.029	0.926	−0.906	0.000 **	−0.856	0.000 **
Total deaths China	−0.536	0.072	0.391	0.209	0.396	0.202
New deaths China	−0.090	0.780	−0.932	0.000 **	−0.951	0.000 **
Fatality rate China	−0.668	0.018 *	0.351	0.264	0.402	0.196
Total cases World	0.341	0.278	0.5723	0.052	0.524	0.080
New cases World	0.264	0.407	0.632	0.027 *	0.582	0.047 *
Total deaths World	0.196	0.541	0.653	0.021 *	0.624	0.030 *
New deaths World	−0.034	0.915	0.627	0.029 *	0.596	0.041 *
Fatality rate World	−0.657	0.020 *	−0.261	0.412	−0.225	0.483

** 99% c.l., * 95% c.l. Source: authors calculations based on Thomson Reuters, World Health Organization coronavirus disease 2019 (COVID-19) situation reports, and the Our World in Data Coronavirus Pandemic (COVID-19) (Roser et al. 2020) database.

Second, to reveal a clearer picture of the impact of the spread of the COVID-19 pandemic on consumer- and business-sentiment indicators, a regression analysis was conducted. The results are provided in Tables 4–6. These results allowed us to make assumptions regarding the reaction of different economic-sentiment indicators in different regions.

The linear regression models for the COVID-19 impact on consumer and business sentiment in the Eurozone are provided in Table 4.

The results in Table 4 (t-values, p-statistics, and R-squared) allows us to state that, when taking into account the period of January 2020 to January 2021, in the case of the Eurozone:

(i) No statistically significant impact of COVID-19-related indicators on the consumer-confidence indicator was identified; i.e., in the long period, no statistically considerable reaction of CCI was observed (although the short-time effect as specified in Section 4.1 was);

(ii) Interestingly, the Eurozone PMI for the manufacturing sector demonstrated a positive reaction to the increase of the cases and deaths of COVID-19 at both the in-country level and globally; i.e., a statistically significant positive impact of the COVID-19-related variables was observed;

(iii) The fatality rate of COVID-19 infection (at the global level) appeared to have a statistically significant negative impact on the business-sentiment indicators in the manufacturing and services sectors (the manufacturing sector PMI also demonstrated a reaction to the changes in the country-level fatality rate); i.e., as in the case of the short period (Section 4.1), in the long period, an adverse business-sentiment reaction was observed.

Table 4. Regression models for COVID-19's effect on the Eurozone economic-sentiment indicators.

Variable	Model Const.	Coef.	t-Value	p-Stat	R-sq.	Observ.
CCI Eurozone						
Total cases Eurozone	−13.902	-1.24×10^{-7}	−0.657	0.525	0.037	13
New cases Eurozone	−13.632	-5.80×10^{-7}	−0.908	0.383	0.069	13
Total deaths Eurozone	−12.679	-1.14×10^{-5}	−1.339	0.208	0.140	13
New deaths Eurozone	−12.739	-4.88×10^{-5}	−1.809	0.098	0.229	13
Fatality rate Eurozone	−11.988	−0.503	−1.677	0.124	0.219	12
Total cases World	−13.778	-2.41×10^{-8}	−0.666	0.519	0.038	13
New cases World	−13.189	-1.68×10^{-7}	−0.993	0.342	0.082	13
Total deaths World	−13.185	-1.65×10^{-6}	−0.979	0.349	0.080	13
New deaths World	−11.331	-1.85×10^{-5}	−2.117	0.058	0.289	13
Fatality rate World	−9.682	−1.302	−1.972	0.074	0.261	13
PMI Manuf. Eurozone						
Total cases Eurozone	46.266	5.71×10^{-7}	2.265	0.045 *	0.318	13
New cases Eurozone	46.069	1.97×10^{-6}	2.288	0.043 *	0.322	13
Total deaths Eurozone	45.139	2.24×10^{-5}	1.932	0.079	0.253	13
New deaths Eurozone	48.476	1.57×10^{-5}	0.325	0.751	0.009	13
Fatality rate Eurozone	57.678	−1.405	−3.445	0.006 **	0.542	12
Total cases World	45.132	1.29×10^{-7}	2.977	0.013 *	0.446	13
New cases World	44.085	6.31×10^{-7}	3.087	0.010 *	0.464	13
Total deaths World	44.074	6.19×10^{-6}	3.018	0.012 *	0.453	13
New deaths World	45.366	2.14×10^{-5}	1.422	0.183	0.155	13
Fatality rate World	62.709	−3.685	−7.513	0.000 **	0.839	13
PMI Serv. Eurozone						
Total cases Eurozone	41.565	2.46×10^{-7}	0.432	0.674	0.016	13
New cases Eurozone	42.113	4.30×10^{-7}	0.219	0.831	0.004	13
Total deaths Eurozone	41.320	8.92×10^{-6}	0.329	0.748	0.009	13
New deaths Eurozone	46.843	−0.0001	−1.329	0.211	0.138	13
Fatality rate Eurozone	51.139	−1.513	−1.522	0.159	0.188	12
Total cases World	40.276	8.20×10^{-8}	0.768	0.458	0.051	13
New cases World	39.598	4.03×10^{-7}	0.788	0.447	0.053	13
Total deaths World	39.384	4.20×10^{-6}	0.832	0.423	0.059	13
New deaths World	43.242	-2.80×10^{-6}	−0.091	0.929	0.001	13
Fatality rate World	64.504	−5.864	−4.065	0.002 **	0.600	13

** 99% c.l., * 95% c.l. Source: authors' calculations based on Thomson Reuters, World Health Organization Coronavirus Disease 2019 (COVID-19) situation reports, and the Our World in Data Coronavirus Pandemic (COVID-19) (Roser et al. 2020) database. Note: Model Const. = Model Constant, Coef. = Coefficient, p-Stat = p-Statistics, R-sq. = R-squared, and Obs. = Observations.

Table 5. Regression models of COVID-19's impact on the United States economic-sentiment indicators.

Variable	Model Const.	Coef.	t-Value	p-Stat	R sq.	Obs.
CCI United States						
Total cases United States	107.242	-9.30×10^{-7}	−1.756	0.107	0.219	13
New cases United States	108.244	-3.79×10^{-6}	−1.974	0.074	0.261	13
Total deaths United States	113.019	-7.47×10^{-5}	2.664	0.022 *	0.392	13
New deaths United States	114.689	−0.0004	−3.559	0.005 **	0.535	13
Fatality rate United States	87.452	2.673	1.701	0.119	0.224	12
Total cases World	107.265	-2.19×10^{-7}	−1.704	0.117	0.209	13
New cases World	110.439	-1.25×10^{-6}	−2.147	0.055	0.295	13
Total deaths World	110.966	-1.29×10^{-5}	−2.266	0.045 *	0.318	13
New deaths World	117.987	−0.0001	−3.754	0.032 *	0.562	13
Fatality rate World	108.677	−2.174	−0.738	0.476	0.048	13
PMI Manuf. United States						
Total cases United States	49.262	5.26×10^{-7}	3.533	0.005 **	0.532	13
New cases United States	49.339	1.82×10^{-6}	3.058	0.011 *	0.459	13
Total deaths United States	47.708	3.19×10^{-5}	3.624	0.004 **	0.544	13
New deaths United States	51.251	5.10×10^{-5}	0.863	0.407	0.063	13
Fatality rate United States	59.621	−1.626	−2.766	0.019 *	0.434	12
Total cases World	48.964	1.33×10^{-7}	3.952	0.002 **	0.587	13
New cases World	47.822	6.60×10^{-7}	4.285	0.001 **	0.625	13
Total deaths World	47.855	6.42×10^{-6}	4.059	0.002 **	0.599	13
New deaths World	48.442	2.66×10^{-5}	2.144	0.055	0.295	13
Fatality rate World	64.662	−3.143	−5.754	0.000 **	0.751	13
PMI Serv. United States						
Total cases United States	52.789	2.65×10^{-7}	1.541	0.152	0.178	13
New cases United States	53.069	7.98×10^{-7}	1.201	0.255	0.116	13
Total deaths United States	52.126	1.54×10^{-5}	1.479	0.167	0.165	13
New deaths United States	55.414	-2.14×10^{-5}	−0.405	0.694	0.015	13
Fatality rate United States	57.584	−0.752	−1.172	0.269	0.121	12
Total cases World	52.654	6.68×10^{-8}	1.623	0.133	0.193	13
New cases World	52.227	3.12×10^{-7}	1.573	0.144	0.184	13
Total deaths World	52.132	3.13×10^{-6}	1.618	0.134	0.192	13
New deaths World	53.344	6.59×10^{-6}	0.519	0.614	0.024	13
Fatality rate World	64.517	−2.654	−5.111	0.000 **	0.704	13

** 99% c.l., * 95% c.l. Source: authors' calculations based on Thomson Reuters, World Health Organization Coronavirus Disease 2019 (COVID-19) situation reports, and the Our World in Data Coronavirus Pandemic (COVID-19) (Roser et al. 2020) database. Note: Obs. = observations, Model Const. = Model Constant, Coef. = Coefficient, p-Stat = p-Statistics, and R-sq. = R-squared.

The regression models for COVID-19's impact on consumer and business indicators in the United States are provided in Table 5.

The results in Table 5 (t-values, p-statistics, and R-squared) allows us to state that, when taking into account the period of January 2020 to January 2021, in the case of the United States:

(i) The consumer-confidence indicator in the United States demonstrated a negative reaction to the growth of deaths caused by COVID-19 infections (cumulative and monthly) both at the country and global levels; i.e., a statistically significant negative impact of the COVID-19 pandemic was confirmed (as it was also observed in Section 4.1);

(ii) As in the case of the Eurozone, PMI in the manufacturing sector in the United States demonstrated a positive reaction to the increase in COVID-19 cases and deaths both at the country level and globally; i.e., a statistically significant positive impact of the COVID-19-related variables was observed;

(iii) As in the Eurozone case, the fatality rate of COVID-19 infections (at the global level) appeared to have a statistically significant negative impact on the business-sentiment indicators in the manufacturing and services sectors in the United States. As in the short period (Section 4.1), an adverse business-sentiment reaction was observed in the extended period.

Table 6. Regression models for COVID-19's effect on China economic-sentiment indicators.

Variable	Model Const.	Coef.	t-Value	p-Stat	R-sq.	Obs.
CCI China						
Total cases China	125.838	-7.80×10^{-5}	−1.594	0.142	0.203	12
New cases China	119.468	6.09×10^{-6}	0.094	0.926	0.001	12
Total deaths China	125.841	−0.002	−2.009	0.072	0.287	12
New deaths China	119.696	−0.0004	−0.287	0.780	0.008	12
Fatality rate China	132.501	−2.700	−2.835	0.018*	0.446	12
Total cases World	118.322	4.92×10^{-8}	1.147	0.278	0.116	12
New cases World	118.406	1.61×10^{-7}	0.866	0.407	0.069	12
Total deaths World	118.629	1.30×10^{-6}	0.633	0.541	0.039	12
New deaths World	119.719	-1.33×10^{-6}	−0.109	0.915	0.001	12
Fatality rate World	125.592	−1.585	−2.758	0.020 *	0.432	12
PMI Manuf. China						
Total cases China	48.916	2.68×10^{-5}	0.566	0.582	0.028	13
New cases China	52.470	−0.0002	−7.098	0.000 **	0.821	13
Total deaths China	46.767	0.001	1.407	0.187	0.153	13
New deaths China	52.736	−0.004	−8.242	0.000 **	0.861	13
Fatality rate China	44.686	1.340	1.240	0.241	0.123	13
Total cases World	49.663	4.84×10^{-8}	1.719	0.115	0.212	13
New cases World	48.886	2.86×10^{-7}	2.281	0.044 *	0.321	13
Total deaths World	48.954	2.71×10^{-6}	2.135	0.056	0.293	13
New deaths World	48.457	1.56×10^{-5}	2.053	0.065	0.277	13
Fatality rate World	53.241	−0.569	−0.892	0.392	0.067	13
PMI Serv. China						
Total cases China	46.913	5.13×10^{-5}	0.443	0.667	0.018	13
New cases China	54.223	−0.0004	−5.379	0.000 **	0.731	13
Total deaths China	40.390	0.003	1.429	0.181	0.157	13
New deaths China	55.129	−0.011	−9.739	0.000 **	0.896	13
Fatality rate China	33.187	3.735	1.453	0.174	0.161	13
Total cases World	47.872	1.08×10^{-7}	1.544	0.151	0.178	13
New cases World	46.115	6.40×10^{-7}	2.029	0.067	0.272	13
Total deaths World	46.088	6.30×10^{-6}	2.004	0.070	0.267	13
New deaths World	44.961	3.60×10^{-6}	1.918	0.082	0.251	13
Fatality rate World	55.572	−1.937	−0.762	0.462	0.050	13

** 99% c.l., * 95% c.l, Source: authors calculations based on Thomson Reuters, World Health Organization Coronavirus Disease 2019 (COVID-19) situation reports, and the Our World in Data Coronavirus Pandemic (COVID-19) (Roser et al. 2020) database. Note: Model Const. = Model Constant, Coef. = Coefficient, p-Stat = p-Statistics, R-sq. = R-squared and Obs. = Observations.

The regression models for the COVID-19 impact on consumer- and business-sentiment indicators in China are provided in Table 6.

The results in Table 6 (t-values, p-statistics, and R-squared) allows us to state that, when taking into account the period of January 2020 to January 2021, in the case of China:

(i) The consumer-confidence indicator in China demonstrated a negative reaction to the fatality rate of COVID-19 infections (both at the country level and globally); i.e., a statistically significant negative impact of the COVID-19 fatality rate was confirmed;
(ii) The China PMI in the manufacturing and service sectors demonstrated an adverse reaction to new COVID-19 cases and deaths per month. The number of cases and

recent deaths per month proved to have a statistically significant negative impact on China's business sentiment (as was also observed in Section 4.1);

(iii) At the same time, China's PMI in the manufacturing sector demonstrated a positive reaction to the global increase of new cases of COVID-19.

The comparison of the results in Tables 4–6 allowed us to make the following assumptions. First, CCI in the Eurozone was not affected by the COVID-19 pandemic. While CCI in China reacted only to the global and country-level fatality rates, CCI in the United States responded to the country-level and global increases in deaths from COVID-19. Second, the Eurozone and the United States PMIs in the manufacturing sector reacted negatively to the rise of fatality rates and positively to the rise in COVID-19 cases and deaths at both the country and global levels. At the same time, the China PMI demonstrated an adverse reaction to COVID-19 at the country level and a positive response to the spread at the global level. Third, the Eurozone and the United States PMIs in the services sector demonstrated an adverse reaction only to the global COVID-19 fatality rate, while China reacted negatively to the increase of new cases and deaths in the country. These results correspond to the results discussed in Section 4.1. (i.e., different reactions of selected economic sentiment indicators in other regions).

In sum, it can be stated that, although the COVID-19 pandemic had a rapid negative short-time effect on consumer-confidence and business-sentiment indicators (in the manufacturing and services sectors), the evidence for a long-term effect was not so unambiguous. On the one hand, (i) in the Eurozone case, the spread of the COVID-19 pandemic had no statistically significant impact on CCI, or affected this index negatively in the United States and China, and (ii) the PMI in the service sector was significantly negatively affected by the fatality rate or mortality risk of COVID-19 infection. On the other hand, the impact on PMI in the manufacturing industry appeared to be mixed, because this indicator demonstrated a positive reaction to the increase of COVID-19 cases and deaths.

5. Conclusions

Our research showed that the lowest level of consumer confidence was observed in the Eurozone. This can be explained by the fact that the COVID-19 pandemic has affected Italy very strongly, and a pessimistic mood spread all over the region. However, the volatility of consumer confidence and uncertainty among households was higher in the United States compared with results for the euro area. The other aspect we would like to point out is that consumer-confidence volatility was lowest in China. This was because consumers in China were affected, and evaluated the possible consequences for a more extended period and did not change their minds about the future. This fact is crucial for future economic growth because the main driver of growth is consumption. Our studies showed that the most pessimistic period for consumers and the biggest shock to their mood and expectations in the euro area and the United States was observed in April 2020, when the first peak of new cases and deaths was observed all over the world. In the case of China, the most pessimistic wave of mood was in February.

Consumers in the euro area were the most pessimistic compared with other regions, but the business segment also demonstrated the most pessimistic mood compared with the US and China. The pessimism was spread among business entities in the manufacturing and service sectors. Those sectors in the euro area experienced the sharpest decline compared with other regions. We also would like to stress that the service sector's expectations were lower than in the manufacturing industry in the euro area and China, while the situation in the United States was the opposite. The lowest volatility of business sentiment in the manufacturing and services sectors was found in the United States. This fact could be explained by government and monetary support for businesses. Every entity needs to be aware of possible help that could lower the negative effects of the COVID-19 pandemic. Regarding the correlation effects, we observed a substantial positive correlation between business sentiment in the manufacturing and services sectors at a country level. We also revealed a robust correlation between PMI (both manufacturing and services sectors) in the

Eurozone and the United States, and a substantial correlation between consumer confidence in the Eurozone and the United States.

The correlation analysis between sentiment indicators and COVID-19 variables showed that the Eurozone consumer-confidence index was not correlated with COVID-19 variables. In contrast, the same index in the United States was strongly negatively correlated with total cases of the COVID-19 pandemic confirmed globally. Consumer confidence in China was strongly negatively correlated with the COVID-19 fatality rate both in China and globally. These conclusions could be used for practitioners to model future economic tendencies or make investment decisions in stressful scenarios.

We also observed that business sentiment in the manufacturing sector in all analyzed regions strongly positively correlated with the global spread of COVID-19 (cases and deaths). Simultaneously, the United States manufacturing PMI positively correlated with, while China manufacturing PMI negatively correlated with, country-level COVID-19 indicators. The Eurozone and United States manufacturing PMI negatively correlated with COVID-19 fatality rate both at the country and global levels. The Eurozone and United States service PMIs were negatively correlated with the COVID-19 fatality rate at both the in-country and international levels. In China, the service PMI was positively correlated with the global spread of COVID-19 and negatively correlated with country-level COVID-19 indicators.

Our study showed no statistically significant impact of COVID-19-related indicators on consumer-confidence indicators. The Eurozone PMI in the manufacturing sector demonstrated a positive reaction to the increase in COVID-19 cases and deaths both in-country and globally.

The fatality rate of COVID-19 infections (at the global level) appeared to significantly negatively impact the business-sentiment indicators in the manufacturing and service sectors.

The regression analysis showed that the consumer-confidence indicator in the United States demonstrated an adverse reaction to the growth of deaths caused by COVID-19 infections. The Eurozone PMI in the manufacturing sector showed a positive response to the increase of COVID-19 cases and deaths of both in-country and globally. As in the Eurozone case, the fatality rate of COVID-19 infections (at the global level) appeared to have a statistically significant negative impact on the business-sentiment indicators in the manufacturing and services sectors in the United States. As in the short period, the adverse business-sentiment reaction was observed in the extended period.

The regression models for COVID-19's impact on consumer- and business-sentiment indicators in China showed that the country's consumer-confidence indicator demonstrated an adverse reaction to the fatality rate of COVID-19 infections (both at the country level and globally). In comparison, China PMI in the manufacturing and service sectors demonstrated an adverse reaction to new COVID-19 cases and deaths per month. The number of cases and recent deaths per month proved to have a statistically significant negative impact on China's business sentiment.

Our results showed that we could have entirely different reactions and tendencies, even in such a critical global situation. So, it is essential to pay attention to those factors while making strategic decisions or creating country-level risk limits, or even when considering regional diversification aspects.

However, it is crucial to notice that this research encountered some limitations. As the economic sentiment indicators analyzed in this research are provided every month, these results are from a relatively small number of observations. Furthermore, given the dynamics of COVID-19-related variables and uneven growth of cases and deaths during the analyzed period, 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.). Nevertheless, the short data series did not allow this to be done. Dealing with these

limitations and the inclusion of more economic sentiment indicators (both general and sectorial) could be the direction for future research.

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Appendix A. Dynamics of COVID-19-Related Variables in the Eurozone

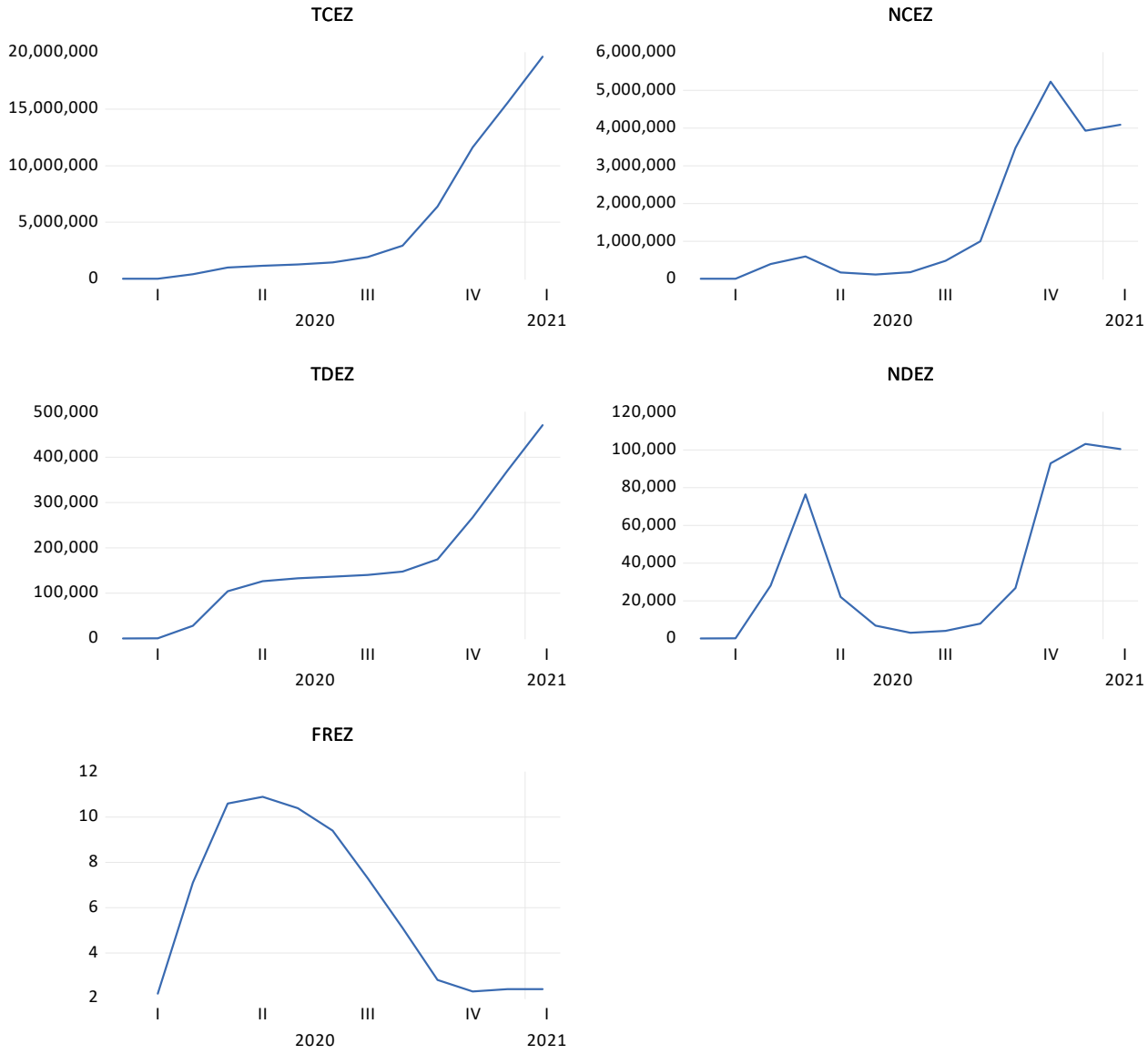

Figure A1. Source: compiled by the authors based on World Health Organization Coronavirus Disease 2019 (COVID-19) situation reports and the Our World in Data Coronavirus Pandemic (COVID-19) (Roser et al. 2020) database. Note: I = 1st quarter, II—2nd quarter, III—3rd quarter, IV—4th quarter. For TCEZt, NCEZt, TDEZt, NDEZt, and FREZt, see Table 1.

Appendix B. Dynamics of COVID-19-Related Variables in the United States

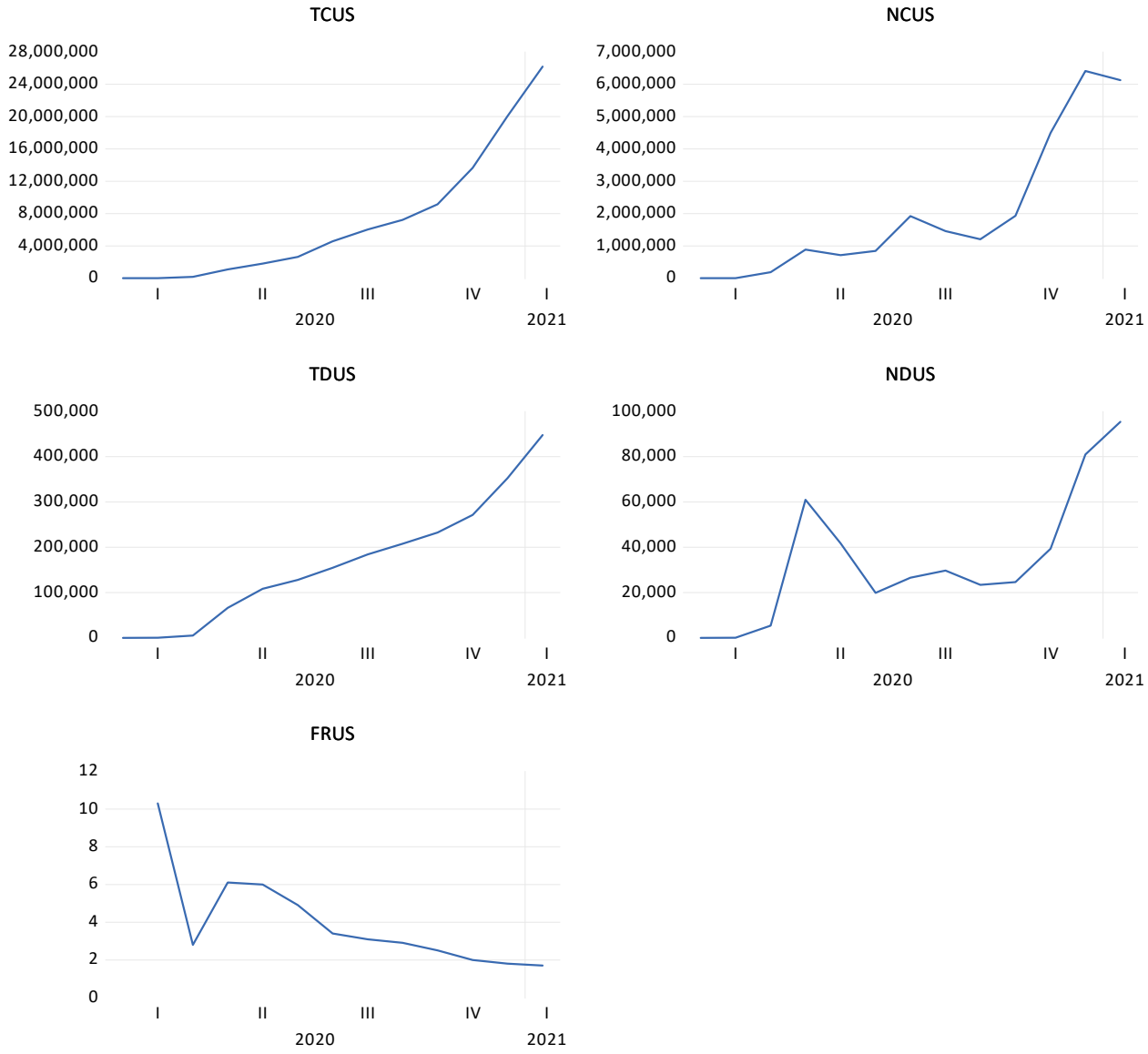

Figure A2. Source: compiled by the authors based on World Health Organization Coronavirus Disease 2019 (COVID-19) situation reports and the Our World in Data Coronavirus Pandemic (COVID-19) (Roser et al. 2020) database. Note: I = 1st quarter, II—2nd quarter, III—3rd quarter, IV—4th quarter. For TCUSt, NCUSt, TDUSt, NDUSt, and FRUSt, see Table 1.

Appendix C. Dynamics of COVID-19-Related Variables in China

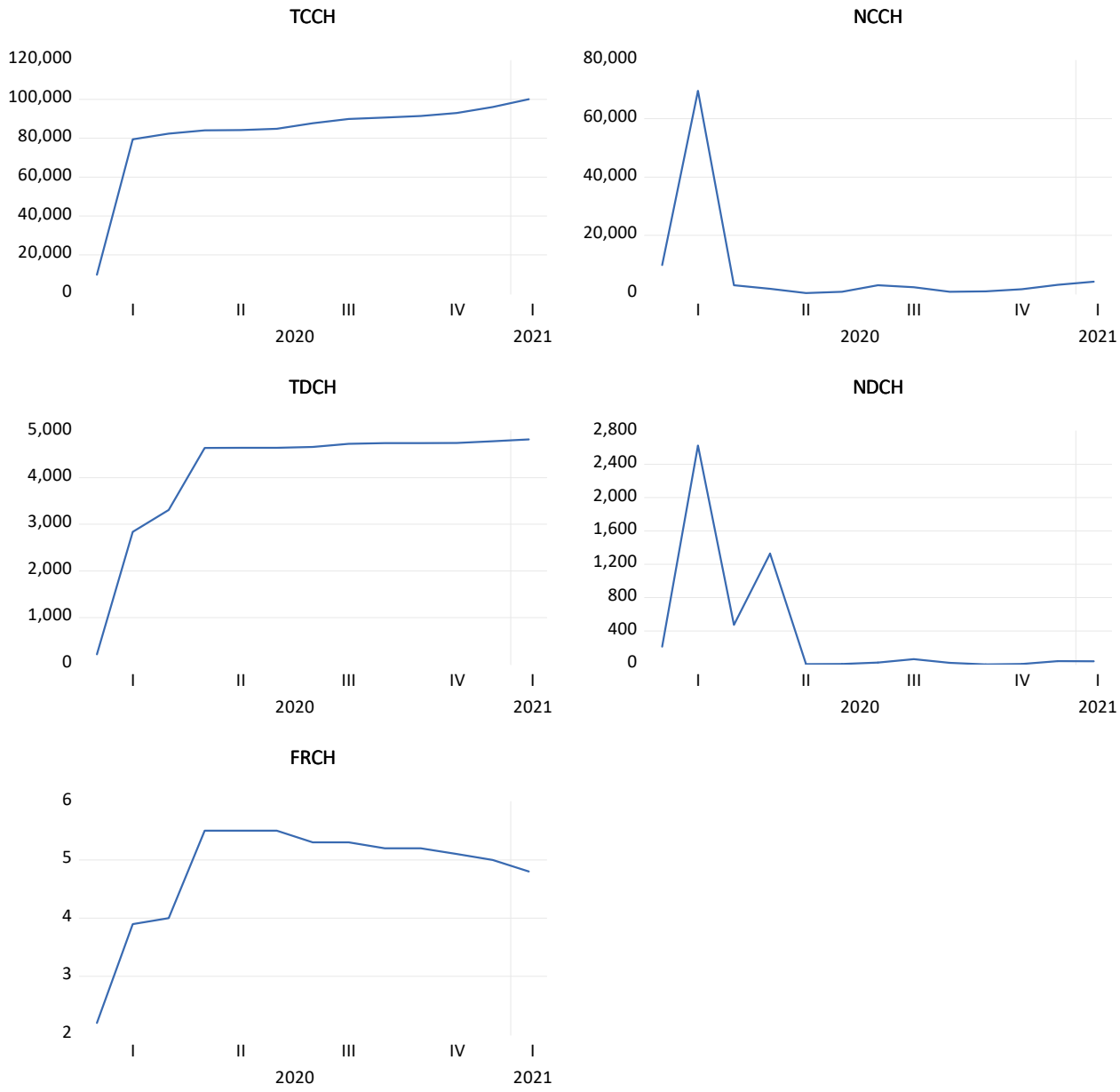

Figure A3. Source: compiled by the authors based on World Health Organization Coronavirus Disease 2019 (COVID-19) situation reports and the Our World in Data Coronavirus Pandemic (COVID-19) (Roser et al. 2020) database. Note: I = 1st quarter, II—2nd quarter, III—3rd quarter, IV—4th quarter. For TCCHt, NCCHt, TDCHt, NDCHt, and FRCHt, see Table 1.

Appendix D. Global Dynamics of COVID-19-Related Variables

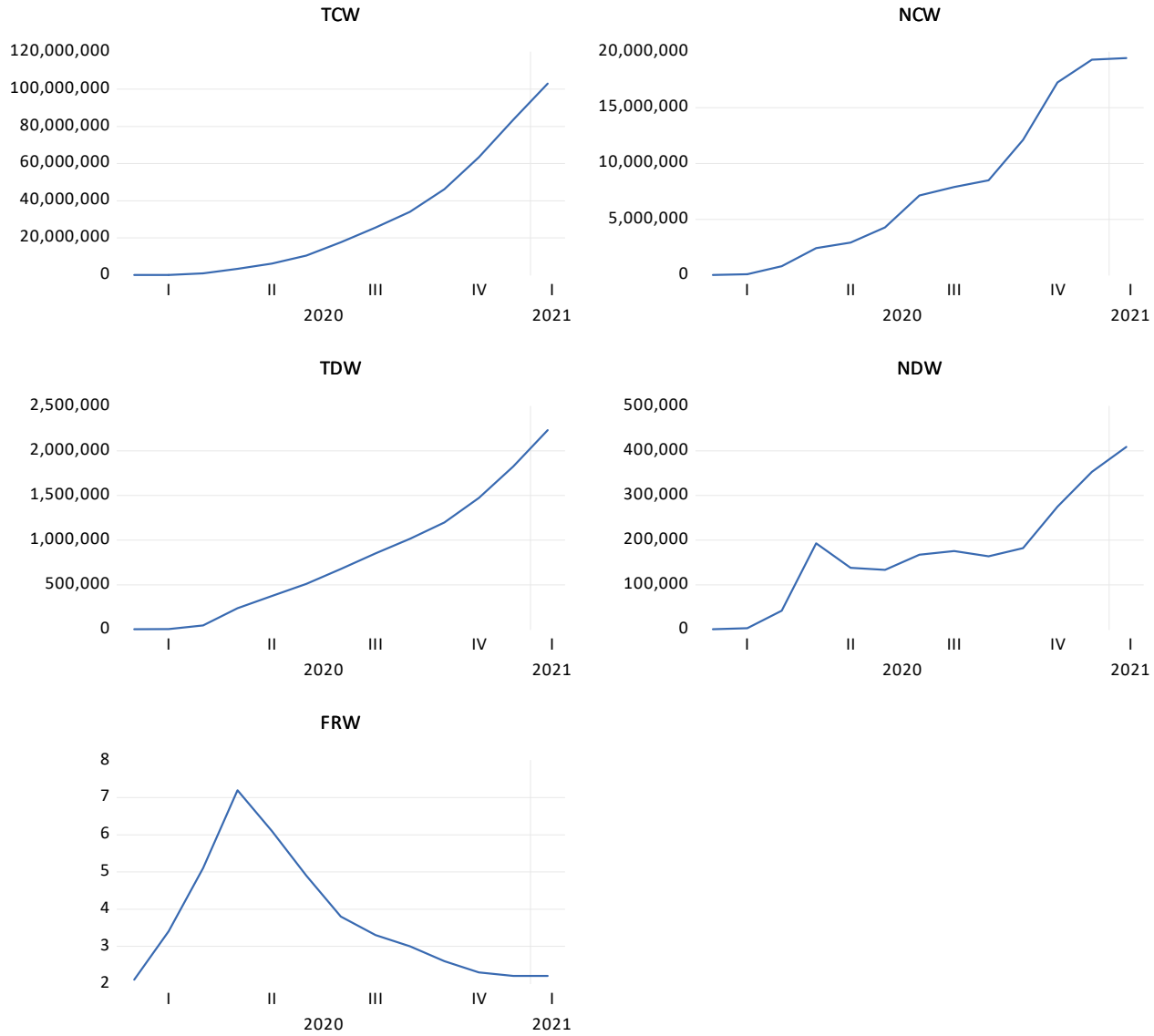

Figure A4. Source: compiled by the authors based on World Health Organization Coronavirus Disease 2019 (COVID-19) situation reports and the Our World in Data Coronavirus Pandemic (COVID-19) (Roser et al. 2020) database. Note: I = 1st quarter, II—2nd quarter, III—3rd quarter, IV—4th quarter. For TCWt, NCWt, TDWt, NDWt, and FRWt, see Table 1.

Appendix E. Correlation between the Eurozone, the United States, and China Economic-Sentiment Indicators of Different Sectors

Table A1. Economic sentiment indicators correlation matrix.

Correlation t-Statistic Probability	CCI China	CCI Eurozone	CCI United States	PMI Manuf. China	PMI Manuf. Eurozone	PMI Manuf. United States	PMI Serv. China	PMI Serv. Eurozone	PMI Serv. United States
CCI China	1 — —								
CCI Eurozone	0.408 1.411 0.189	1 — —							
CCI United States	0.513 1.894 0.088	0.843 4.957 0.001 **	1 — —						
PMI Manuf. China	0.177 0.569 0.581	−0.476 −1.712 0.118	−0.573 −2.211 0.052	1 — —					
PMI Manuf. Eurozone	0.396 1.363 0.203	0.423 1.476 0.171	0.071 0.226 0.825	0.348 1.176 0.267	1 — —				
PMI Manuf. United States	0.369 1.256 0.238	0.259 0.851 0.415	−0.082 −0.260 0.799	0.482 1.737 0.113	0.961 10.959 0.000 *	1 — —			
PMI Serv. China	−0.006 −0.018 0.986	−0.456 −1.618 0.137	−0.599 −2.369 0.039 *	0.930 8.013 0.000 **	0.323 1.081 0.305	0.440 1.550 0.152	1 — —		
PMI Serv. Eurozone	0.154 0.493 0.633	0.633 2.588 0.027 *	0.256 0.838 0.422	0.050 0.158 0.877	0.813 4.409 0.001 **	0.689 3.008 0.013 *	0.160 0.514 0.619	1 — —	
PMI Serv. United States	0.262 0.858 0.411	0.634 2.591 0.027 *	0.279 0.919 0.379	0.138 0.441 0.669	0.920 7.444 0.000	0.842 4.929 0.001 **	0.154 0.494 0.632	0.906 6.778 0.000 **	1 — —

** 99% c.l., * 95% c.l. Source: compiled by the authors based on Thomson Reuters data.

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