Labor Market Trends During The COVID-19 Pandemic

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The COVID-19 pandemic has caused several disruptions in almost all day-to-day matters around the world. To keep things under control, ever since the beginning worldwide authorities-imposed restrictions in relation to physical activities and therefore, organizations were forced to rethink the way they carry out professional activities. Thus, most areas that were based on the physical interaction between people were severely impacted by these sets of measures. Unfortunately, a negative impact that the pandemic state has had over the fields that were based on physical work is that economic pressure has forced some of the entities to completely suspend their activity, leading to high rates of unemployment around the world, which also led to consistent financial efforts sustained by the government. To gain relevant conclusions, we analyzed several datasets that offer insights over all aspects of the labor market around the world mainly before and during the pandemic period. We also computed a correlation matrix based on economic sectors to compare the effects in the labor market for various industries. We analyzed the evolution of unemployment rate from Romania, commented on the breakdown of job loss by activity, interpreted the evolution of mobility based on Google data, explained the correlation between unemployment rate and the application of restrictive measures.
Keywords: COVID-19, Labor Market, Unemployment, GDP

1 Introduction
1.1 COVID-19 Pandemic

Shortly after discovering the respiratory disease caused by a new type of coronavirus that is related to the virus that causes severe acute respiratory syndrome (SARS), it has been named Coronavirus Disease 2019 (COVID-19), as stated in [1]. The new virus knows its epicentre in Wuhan, Hubei Province in People's Republic of China and has spread throughout the world, having an exponential rate of transmission.

At the time of writing this paper, institutions estimate that more than 120 million people worldwide were tested positive for the new coronavirus. Evidence shows that 2.7 million people died because of complications caused by SARS-CoV-2, which represents a rate of 2.21% of people who cannot fight against the disease [2].

However, starting from the beginning of 2021, major regulators approved the usage of COVID-19 vaccines and most of the countries started administering them in various forms and timelines. The most common approach was starting with first-line workers (i.e.: law enforcement, medical staff) and people that were at high risk of suffering from severe forms of the aforementioned disease (i.e., people over 65 years old, chronic ill people).

Moreover, [3] states that even though mass vaccination will slowly decrease the rate of infection among people, the production, distribution, and availability of the vaccines represent major challenges and significant efforts are put in place to overcome them.

Our World in Data [2] estimates that the number of people around the world that received the first dose of any available vaccine is as high as 251 million, while the number of people who can be categorized as fully vaccinated is 97 million. The numbers are based on statistics gathered at the time of writing this paper.

Based on the provided data, evidence suggests that even though we are heading towards the

end of the pandemic, it is not likely to end soon, and we must learn to live through it. Therefore, society needs to adapt to the recent changes to overcome the obstacles generated by the pandemic situation.

1.2 Labor Market in General
COVID-19 has had a significant impact on the labor market. Wherever possible, many businesses were forced to adapt to the new ways of operating, but unfortunately, too many companies were unable to survive this difficult period and were forced to close business with no specific reopening time frame, resulting in a high rate of unemployment around the world and significant financial burden on them and the governments, as they needed to support their citizens as usual but while generating less income [4].

Data provided by Eurostat [5] shows that the pandemic state, which was declared in March 2020, resulted in a surge in the unemployment rate, which increased from 5.9% in March to 6.7% in April, the peak being registered in August 2020 at a rate of 7.35%.

According to [6], the risk of a temporary layoff was highest in the accommodation and food industries, while the risk of losing a job permanently was highest for temporary workers, young people (aged 16 to 24), and low-skilled professionals.

[6] examines the effect of COVID-19 on income distribution and finds that low-income earners were the most affected by layoffs or reducer work hours, while high-income earners were the least affected.

The EU labor market was heavily impacted in the first few months after the pandemic began (Q2 2020), which is vastly considered the most crucial period: online job listings dropped by 31%, with a major disparity between western (-33%) and eastern countries (-15%) [7]. In Romania during 2020, the unemployment rate increased by 1.4% compared to the end of 2019 (4.1%) [8].

2 Related Work
The COVID-19 pandemic has stimulated sustained research efforts to explore its effects on various fields such as medicine, computer science and artificial intelligence, as well as how we can more effectively tackle it and what can be done to prevent negative pandemic effects from resurfacing in the future.

For this article, we analyzed a series of papers that studies the COVID-19 pandemic and its effects on the labor market.

[9] describes a model that was developed to examine how the COVID-19 pandemic-induced recession affects the labor market and what the patterns are when it comes to job openings in the United States. The aforementioned paper analyzes the monthly total number of work vacancies between January 2001 and July 2020 using two data sources: Current Population Survey (CPS) data collected between January 2001 and August 2020, and Job Openings and Labor Turnover Survey (JOLTS) data collected between January 2001 and July 2020. However, the paper argues that forecasting potential unemployment rates triggered by the COVID-19 pandemic based on previous recessions is difficult as the higher outflow rates are driven by the temporarily unemployed people that will resume working. From another perspective on the same subject, [10] analyzes the effect of the COVID-19 pandemic over the unemployment rates and offers an estimate on how high the unemployment rate will get and the duration it will stay high. The projections they offered in 2020 for the unemployment rate were that it will "likely peak below 20 percent and will come down rather swiftly over the last two quarters of this year", which proved to be true, based on [11].

[12] is a paper written by a group of students in vocational psychology that analyzes the impact of the COVID-19 pandemic on the labor market from different perspectives. First, the paper presents the difference between people with stable jobs that had to make the switch to working from home and face the challenges (work-life balance, childcare, difficulties in going out) and the others that cannot work from home and the challenges they face while putting themselves at risk every day and having a higher chance of being laid off or temporarily lose their job.

[13] takes another approach and moves the focus from the unemployment rate towards the

negative effects that it can lead to, a drop-in life expectancy and a rise in the mortality rates that will affect the US population. The paper uses Vector Autoregression (VAR) to assess the long-term effects of the COVID-19 recession and its related unemployment shock on life expectancy and mortality rates.

[14] conducted a Real Time Population Survey to assess the impact of the pandemic on the labor market in the United States. The goal of the project is to offer real-time data as opposed to the statistics offered by the Bureau of Labor Statistics in its monthly reports. From the authors' findings, the labor market is currently on the way to regain its lost vitality pointing towards a slowly improving employment rate.

3 Our work

Our primary goal is to assess the extent of the labor market damage caused by the COVID-19 pandemic as the initial shock wears off. During our research, we looked at data from two of the world's most representative markets: the European Union and the United States. We have also explored the evolution of Romanian unemployment rate. We considered a variety of factors and rates during our research, including job vacancies, total layoffs, total hires, and the unemployment rate. Our attempt to correlate the data with basic COVID-19 statistics such as the total number of cases or daily new cases has proven

to be a difficult task, owing to the pandemic's unpredictable nature (i.e.: multiple waves). Thus, we used GDP as a representative economic indicator in the times of the COVID-19 pandemic and we correlated it with labor market data for the analyzed geopolitical areas and compared the results.

Research hypothesis: In March-April 2020, the labor market in the United States of America and the European Union suffered a major disturbance triggered by the COVID-19 pandemic and was able to recover itself later.

3.1 Methodology

We gathered data from a variety of sources to validate our research hypothesis. The first set of data concerns the global situation surrounding the COVID-19 pandemic. As a result, we examined the following indicators, which have been tracked since the beginning: total number of cases, total number of people who have received at least one vaccine dose, and total number of people who have been fully vaccinated. Our World in Data provided data on the COVID-19 pandemic, which was compiled from official sources all over the world. The United States Census Bureau, the official insights provider for the United States, and Eurostat, the official institution that provides data and analysis for the European Union, were the two major data sources used to gather data about the labor market during the COVID-19 pandemic.
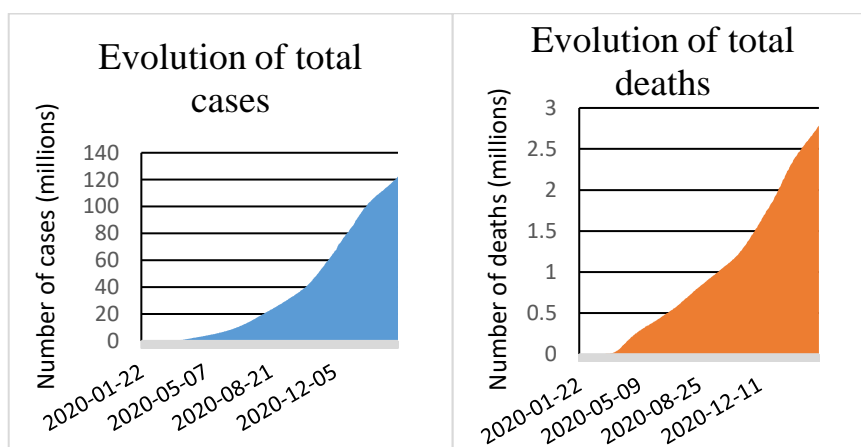
Fig. 1. Evolution of COVID-19 total cases and deaths since the beginning of the pandemic [2]

As a result, we examined the following indicators to provide a clear picture of how certain

indicators have evolved in the United States, Europe, Romania, and around the world:

unemployment rate, total job openings and vacancies, total separations, and general indicators about the likelihood of losing one's job. All the information discussed here pertains to the time frame prior to and during the pandemic.

Furthermore, we examined job openings by sector to determine which ones have been struggling, which ones have remained unaffected, and which ones have been on an upward trend.

We filtered the data from 2019 to the present to provide an accurate depiction of the current situation. Furthermore, since we mainly worked with months, we aggregated daily data to monthly to get a better picture of the situation.

Figure 1 represents the total number of people who contracted the new coronavirus and the number of people that died because of complications caused by the disease it causes, COVID-19. More than 120 million people worldwide got infected, and 2.7 million could not lead the fight.

Figure 2 represents the number of people around the world who received the first dose of any available vaccine and the number of people who are declared as fully vaccinated. At the time of writing this paper, a total of 251 million people received at least one dose of the vaccine and 97 were fully vaccinated.
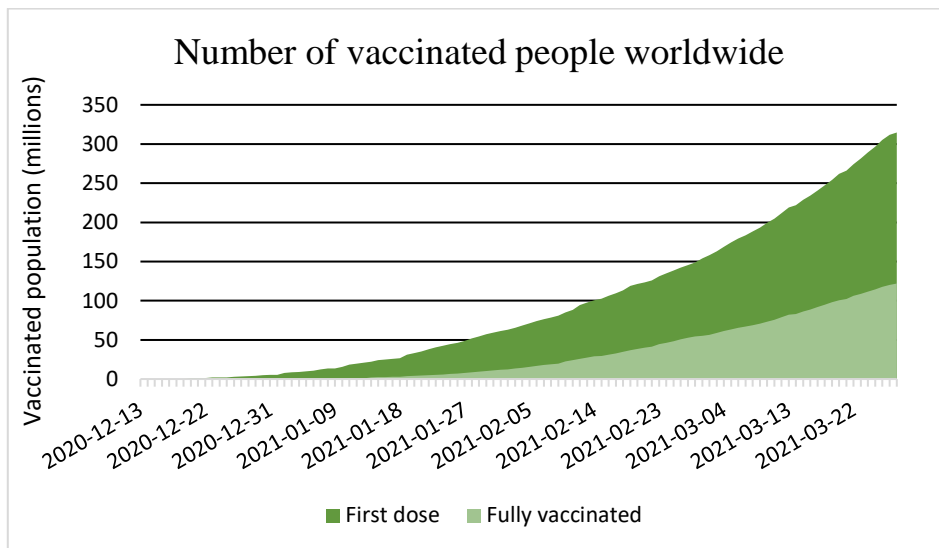

Fig. 2. The number of people that took one of the existing COVID-19 vaccines [2]

Figure 3 demonstrates that COVID-19 outbreak that started in March 2020 around the world has caused a surge in the unemployment rate, going from 5.9% to 6.7% in just one month. The peak was registered in August 2020 at a rate of 7.35%.
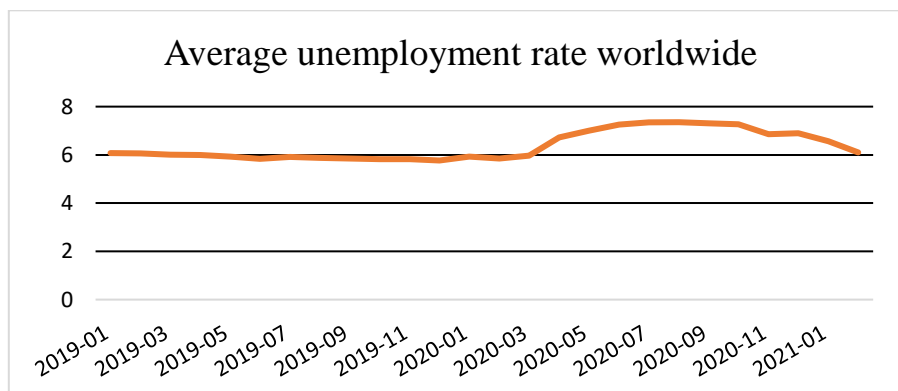

Fig. 3. Evolution of unemployment rate starting from 2019 [15]

As per Figure 4, European Centre for the Development of Vocational Training (CEDEFOP) states that during the most impacted period, online job postings fell by 31%.

Western countries were more affected than the eastern ones, and there was also a difference in the way the countries recovered after the first wave of the pandemic.
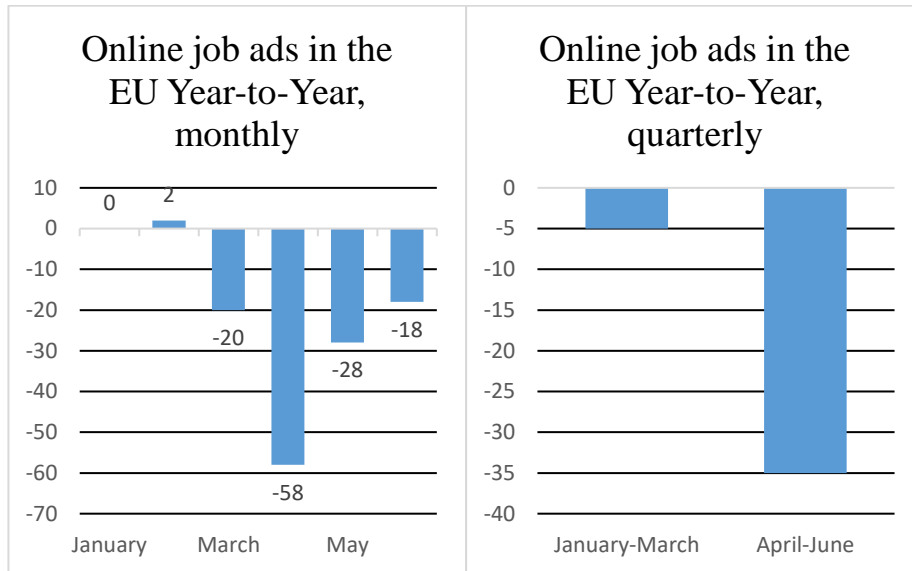
Fig. 4. Online job ads in the EU Year-to-year, monthly and quarterly [7]

As was expected during a global health crisis, the least affected jobs were related to healthcare and social workers while at the opposite end, the least resilient jobs were in the food and hospitality industries, an understandable situation given the strict measures that many countries imposed during national lockdowns, such as the closing of indoor dining venues and banning tourism.

In the United States, the severity of the economic impact caused by the restrictive measures may also be suggested by the quick recovery of the unemployment rate as soon as states began lifting said restrictions and allowing non-essential businesses to reopen. The Employment Situation Summary, released in May 2020 by the Bureau of Labor Statistics [16] indicates a recovery of approximately 2.5 million jobs in May 2020, after a very sharp increase of the unemployment rate in Mar-Apr 2020.

According to [17], which calculated the probability of defaults (PD) as the key indicator based on asset volatility and stock price movements, the most affected industries during the first 6 months of the pandemic were airlines, leisure facilities, oil & gas drilling, auto parts & equipment and restaurants.

According to [18] which studied the impact of the pandemic on small businesses across the United States and their prospects for a full recovery. In the pessimistic scenario, industries such as Arts, entertainment & recreation, or Accommodation and Food Services will not return to pre-2020 levels before 2025. On the opposite end Healthcare services, Information and Real Estate are expected to return to normal before 2021 ends.

Succeeding in the new normal is a very difficult task for many businesses and they will need to adapt to certain changes that are here to stay and entrepreneurs may also be needed to remodel their business plans according to the new society's needs.

Figure 5 and table 1 emphasize the spike known by the lay-offs in March 2020 and April 2020. The growth rate was similar between fields. As observed in the table, the most affected industries are Leisure and hospitality and Accommodation and Food Service Activities, as an effect of reduced travel activities.
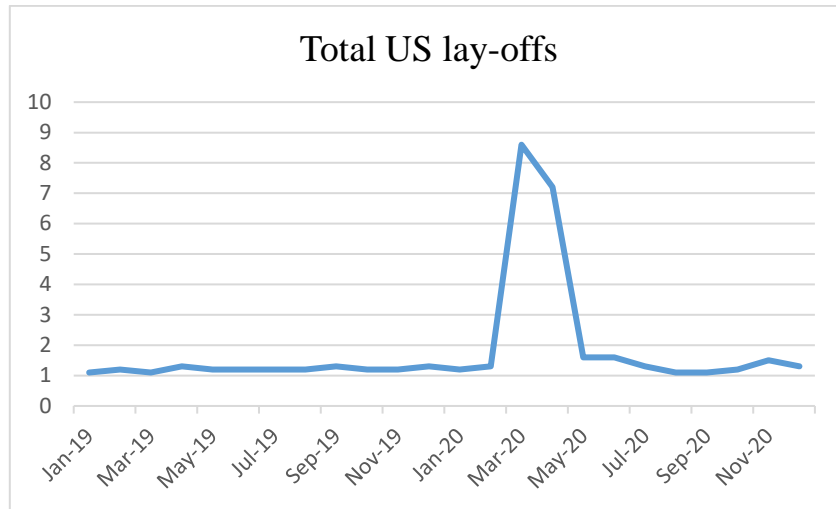
Fig. 5. Total US layoffs starting from January 2019 until December 2020 [11]

Table 1. US lay-offs split by fields [11]

Field	Month							
	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20
TOTAL	1.3	1.2	1.3	8.6	7.2	1.6	1.6	1.3
Mining and Logging	2.5	0.9	0.8	5.2	9.8	3.5	2.5	2.3
Construction	3.2	2.4	2.6	8.3	10.9	2.8	2.7	2.6
Manufacturing	0.9	1	1.1	5.6	6.3	1.3	1.7	1.4
Trade, transportation, and utilities	1.3	1.1	1.5	7.5	6.9	1.8	1.6	1.2
Information	1.7	0.7	1.1	6.8	6.3	1.4	1.5	0.8
Financial activities	0.5	0.5	0.8	2.8	2.7	0.7	1.2	0.9
Professional and business services	2.2	1.9	1.9	6	6.3	2.3	2.1	2.1
Education and health services	0.6	0.7	0.7	6.3	5	1.2	0.9	0.8
Leisure and hospitality	2	1.8	1.9	32.1	26.4	2.3	2.8	2.3
Wholesale and Retails Trade	1.05	0.9	1.35	6.55	6.45	1.75	1.4	0.95
Accommodation and Food Service Activities	1.6	1.4	1.7	33.2	25.3	1.8	2.3	1.9
Real Estate Activities	1	0.4	1.2	7	8.3	1.6	1.3	1.6
Education	0.7	0.5	0.8	8.7	8.1	1.1	1	1.2
Human Health and Social Work activities	0.6	0.7	0.7	5.9	4.5	1.2	0.9	0.7
Arts, Entertainment and Recreation	4.5	3.6	3.2	25.7	33.1	5.9	6.6	5.5

To see how much the increase in unemployment affects the shrinking of the GDP in the United States, a correlation was made between the values of the unemployment rate reported to the GDP. In our study, we used the following correlation formula:

$$r = \frac{\Sigma(x-\underline{x})(y-\underline{y})}{\sqrt{\Sigma(x-\underline{x})^2 \Sigma(y-\underline{y})^2}}, (1)$$

where x represents the unemployment rate, y denotes GDP, and r signifies the correlation coefficient, which can range between -1 and 1.

The first case of COVID-19 from Romania was reported on 26th of February 2020, and the Government subsequently implemented several measures to limit its spread, such as declaring the state of emergency, population testing, social distance measures, including the closure of schools and entertainment activities, restrictions on travel and internal movement and limiting fuel and utility prices. The reopening of the economy began gradually on 15th of May 2020, at the same time as the state of emergency was lifted. Most notably, the prohibition on performing several activities in certain areas (barbershops, libraries, dental offices, etc.) was lifted and restrictions on population movement were gradually eased. The second round of relaxation was implemented on 1st of June 2020, lifting restrictions on traveling between cities, resuming international transport of vehicles and trains, opening terraces and beaches, etc. Subsequent easing measures were implemented since 15th of June 2020, such as the opening of shopping centers (excluding food courts and cinemas), gyms and kindergartens.

Following the increase in the number of cases, new preventive measures entered into force on 1st of August 2020, including the mandatory wearing of masks in congested open spaces and the limitation of the operating hours for outdoor restaurants and clubs. Schools were reopened on 14th of September 2020 under certain conditions. Other restrictions were introduced locally at the beginning of October 2020: the re-closing of restaurants, bars, theatres and cinemas in Bucharest and the compulsory wearing of masks 50 meters from educational institutions. It should be noted that some of these restrictive measures are present, in one form or another, at the time of the present analysis.

3.2 Results
To validate our hypothesis, we measured the correlation coefficient r for the United States of America but not for the European Union, since Eurostat had not yet published the official unemployment rate figures for Q4 2020 at the time of writing this article.
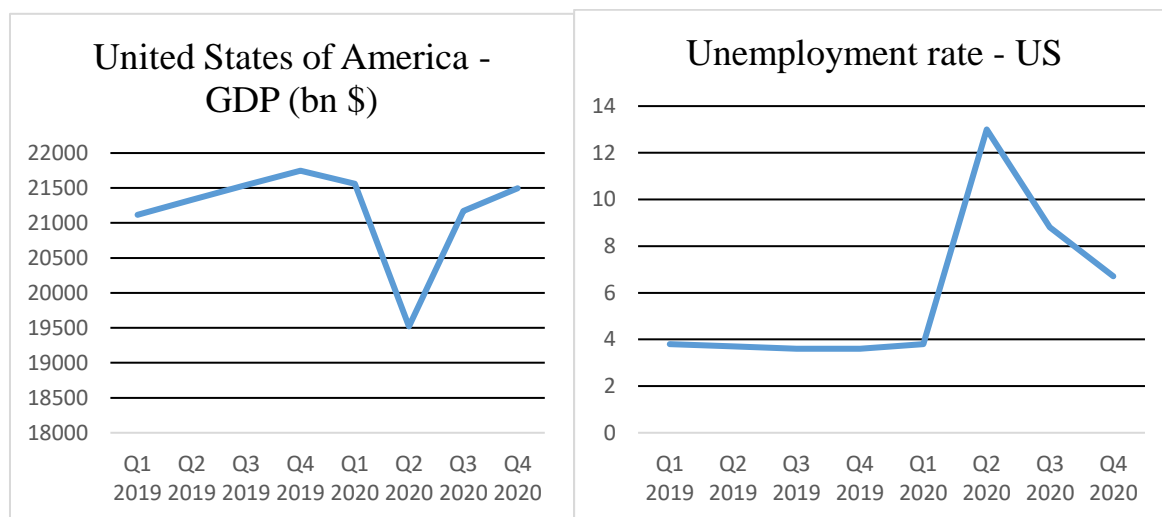
Fig. 6. GDP and unemployment rate in the United States [19]

Figure 6 presents both indicators' evolution during the same period. The correlation coefficient was calculated at -0.86, a value close to -1, indicating a strong negative linear correlation between the unemployment rate and the gross domestic product in the United States of America.

Before the pandemic, the Gross Domestic Product of the United States was slowly and steadily increasing quarter by quarter but suffered a dramatic loss (approximately 9.5%) once the pandemic has erupted, causing many disruptions and layoffs on the labor market. After the initial shock wore off, the economy began its recovery, regaining its vitality and

indicating a full recovery soon, as the vaccination rate continues to grow around the world.

A correlation matrix was made based on the layoffs rate for all the available industries, shown in Table 2.

	Mining and Logging	Construction	Manufacturing	Trade, transportation, and utilities	Information	Financial activities	Professional and business services	Education and health services	Leisure and hospitality	Wholesale and Retails Trade	Accommodation and Food Service Activities	Real Estate Activities	Education	Human Health and Social Work activities
Construction	0.94													
Manufacturing	0.92	0.98												
Trade, transportation, and utilities	0.87	0.96	0.99											
Information	0.86	0.97	0.98	0.99										
Financial activities	0.87	0.95	0.99	0.98	0.98									
Professional and business services	0.90	0.98	0.99	0.99	0.99	0.97								
Education and health services	0.83	0.94	0.97	0.99	0.99	0.97	0.98							
Leisure and hospitality	0.82	0.95	0.97	0.99	0.99	0.97	0.98	1.00						
Wholesale and Retails Trade	0.89	0.97	0.99	1.00	0.99	0.98	0.99	0.99	0.98					
Accommodation and Food Service Activities	0.80	0.93	0.96	0.98	0.99	0.96	0.97	1.00	1.00	0.98				
Real Estate Activities	0.93	0.99	0.99	0.98	0.98	0.97	0.98	0.96	0.96	0.98	0.95			
Education	0.87	0.97	0.98	0.99	0.99	0.98	0.99	0.99	1.00	0.99	0.99	0.98		
Human Health and Social Work activities	0.81	0.93	0.96	0.99	0.99	0.97	0.97	1.00	0.99	0.99	0.99	0.95	0.99	
Arts, Entertainment and Recreation	0.94	0.99	0.99	0.97	0.97	0.97	0.98	0.95	0.95	0.97	0.94	0.99	0.97	0.94

Table 2. Correlation matrix

As it can be observed, all the 105 total correlation coefficients have values of over 0.8 indicating a strong positive linear correlation. Since all the analyzed industries are positive and with values close to 1, it is safe to assume that the pandemic has affected the labor market in a similar manner, regardless of the economic sector.

Interpreting the data presented in Figure 7, during 2020, the unemployment rate increased by 1.4 percentage points compared to the end of 2019 (4.1%), peaking at 5.5% at the end of June 2020. Subsequently, in July 2020 the rate was 5.4%, down 0.1 percentage points from

the previous month, remaining on a downward trend until December, when it registered a slight increase (0.2 percentage points compared to the previous month). It is quite possible that this upward trend will continue as there is a risk of further job losses in the coming months if government support schemes are removed and new restrictive measures are reintroduced. The unemployment rate increased, at least partially, because of the measures implemented by the authorities to slow the spread of the COVID-19 pandemic. At the same time, it remained relatively low during the pandemic, thanks to the measures taken by the authorities to support employers.
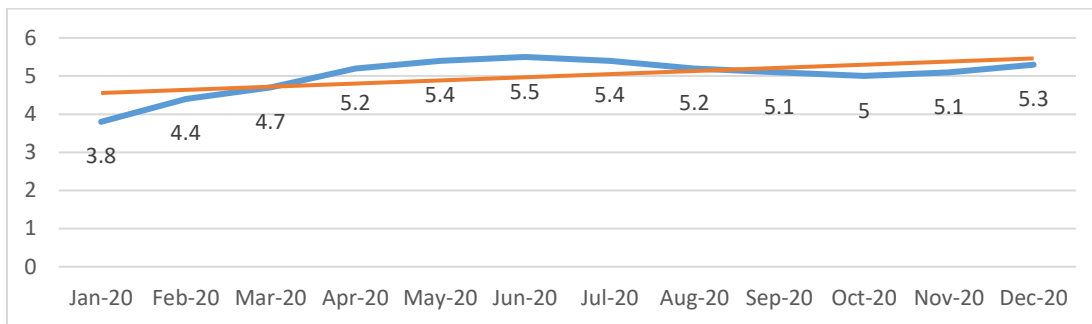

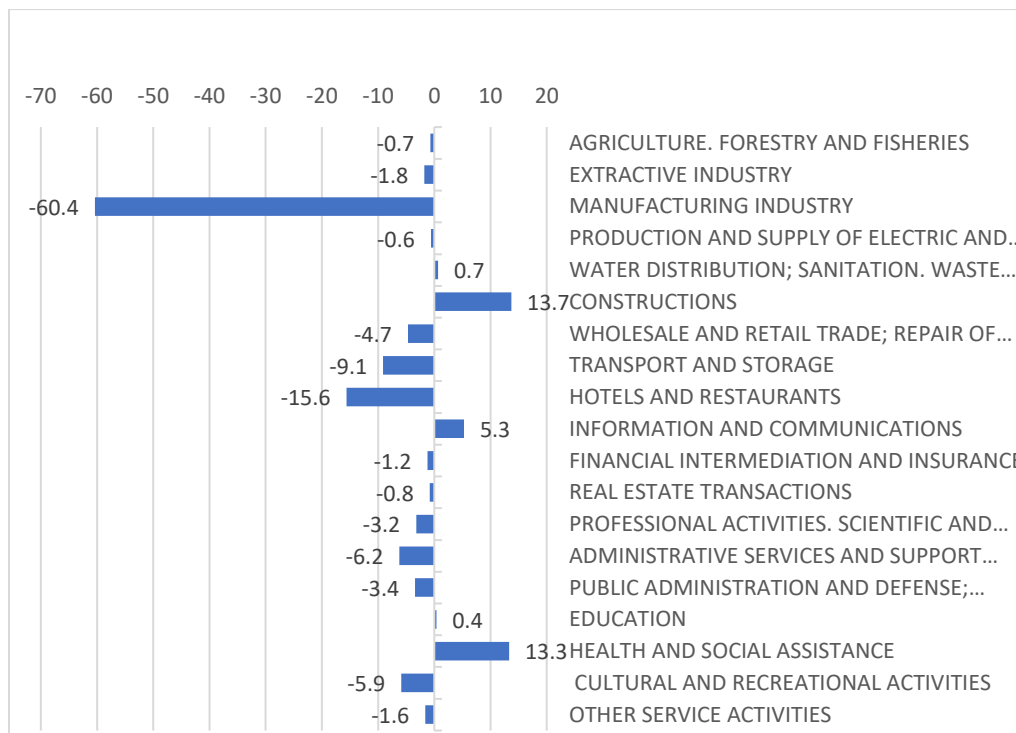**Fig. 7.** The evolution of Romania's unemployment rate [8]

Fig. 8. The breakdown of job loss by activity (thousands) [20]

As regards the breakdown of job loss by activity (Figure 8), the data from the National Institute of Statistics (NIS) shows an overall loss in 2020 of around 81,800 jobs or 1.63% of all jobs available in 2020.

From the interpretation of the data presented in the graph above, the biggest job losses during the period January - December 2020 were recorded mainly in the manufacturing sector (60.400 jobs or 0.05% of the jobs available from this sector), in the Hotels and Restaurants sector (15.600 jobs or 7.12% of jobs available in this sector) and in the Transport and Storage sector (9.100 jobs or 3.4% of available in this sector). In respect of the sectors that have experienced employment growth, there can be mentioned the Construction sector (13.700 jobs or 3.42% of jobs available in this sector), the Health and Social Care sector (13.300 jobs or 3.3% of jobs available in this sector) and the Information and Communications sector (5.300 jobs or 2.73% of jobs available in this sector).

As expected, the most affected sectors were those where direct human interaction was necessary to carry out the activity (as the restrictive measures aimed precisely at reducing this interaction in order to prevent the spread of the virus). At the same time, the sectors that were positively affected by the pandemic were those where the implementation of protective measures was easier (masks, social distance, etc., as is the case of the Construction sector), the activity could be carried out in the online environment (trade, work from home, etc., the Information and Communications sector) or the need for new employees was pressing to meet the health challenges (such as the Health and Social Care sector).

A useful approach for research on unemployment, from the perspective of the restrictive measures imposed by the authorities, would be the evolution of mobility in Romania, in the idea that it can be used to approximate the evolution of economic activity and, therefore, unemployment. The hypothesis taken under consideration is a direct correlation between the two variables, so the increase/decrease in mobility leads to a similar response of economic activity.

Therefore, as regards the evolution of mobility in Romania, according to the mobility data provided by Google, it can be seen a significant decrease in mobility in five areas (Retail and Recreation, Grocery and Pharmacy, Transit Stations, Workplaces and Parks) from the six monitored areas (Figure 9). The explanation is that, from mid-March 2020, when the outbreak of the COVID-19 pandemic was confirmed, the authorities intervened by establishing a state of emergency (Presidential Decree No 195/16 March 2020). Subsequently, the state of emergency was extended by a further 30 days, starting on 15th of April 2020 (Presidential Decree No. 240/14th of April 2020). The observation is also confirmed by the increase in the number of people who have spent more time at home, the Residential area.

After the lifting of the state of emergency, which can be assimilated with the beginning of the relaxation of restrictions, there is an increase in mobility. Thus, five of the six areas analyzed (Retail and Recreation, Grocery and Pharmacies, Transit Stations and Workplaces) recorded an increase in mobility, but not enough to return to pre-pandemic levels, with the Parks area experiencing the most significant increase in mobility (which is also explained by the fact that the summer months overlapped with the relaxation of restrictions). As expected, the Residential area recorded a decrease in mobility, as the relaxation of restrictions has allowed people to resume some of their daily activities. Subsequently, following an increase in the number of cases, new preventive measures came into force on 1st of August 2020.

As a result, the evolution of mobility is switched back to the trend from the onset of the introduction of restrictive measures, with small variations. Overall, however, mobility has not returned to pre-pandemic levels, a possible explanation being also the implementation of the possibility to work from home.
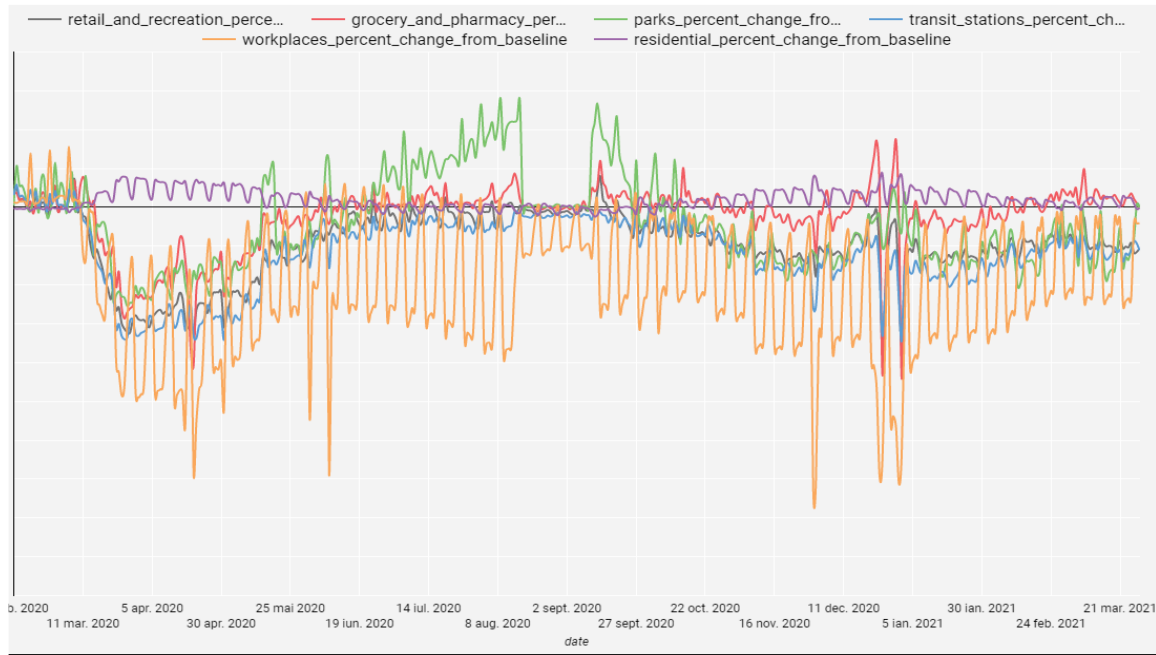
Fig. 9. The evolution of mobility in Romania (Google) [21]

Given that voluntary social distance, driven by the fear of infection, even when restrictions are relaxed, has an impact on mobility (a one-unit increase in the number of daily deaths per capita leads to a statistically significant decrease of up to 0.5 pp in mobility) [22], we detail the analysis by trying to isolate the effects that restrictive measures (approximated by the Oxford University's stringency index) had on the unemployment rate in Figure 10.
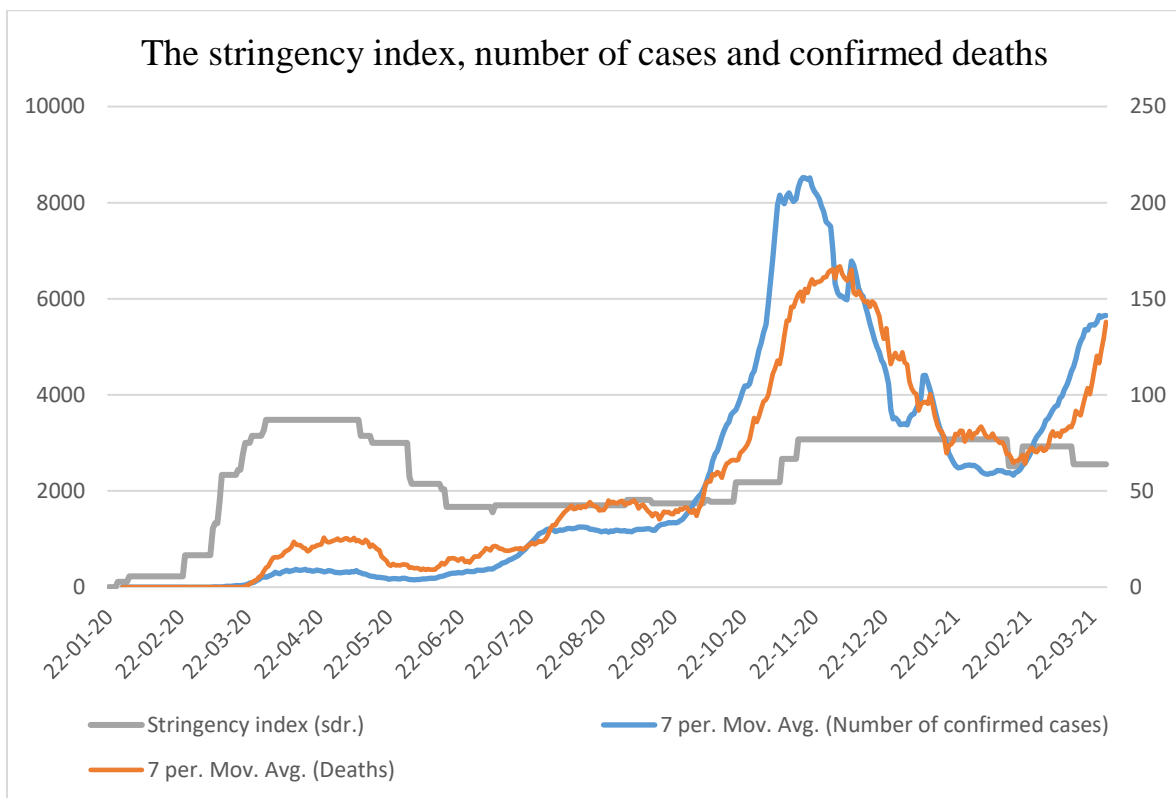
Fig. 10. The stringency index, number of cases and confirmed deaths [23]

To this end, we used the regression function in Excel, for the period January to December 2020, for 12 observations, i.e., the unemployment rate for each month of 2020 and the monthly average of the values of the stringency index. The results of the regression are presented in Table 3.

Table 3. Regression results

1	SUMMARY OUTPUT							
2								
3	*Regression Statistics*							
4	Multiple R	0.747758						
5	R Square	0.559142027						
6	Adjusted	0.51505623						
7	Standard	0.341746433						
8	Observati	12						
9								
10	ANOVA							
11		*df*	*SS*	*MS*	*F*	*Significance F*		
12	Regressio	1	1.481260419	1.481260419	12.68304	0.005169827		
13	Residual	10	1.167906247	0.116790625				
14	Total	11	2.649166667					
15								
16		*Coefficients*	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
17	Intercept	4.318712276	0.217323824	19.87224504	2.28E-09	3.834484621	4.802939931	3.834484621	4.802939931
18	Stringency	0.013838142	0.003885671	3.561325902	0.00517	0.005180327	0.022495957	0.005180327	0.022495957

The regression analysis shows that, relative to the R Square coefficient, approximately 56% of the change in the unemployment rate can be explained by the introduction of restrictive measures. The value of the coefficients indicates a positive relationship between the two variables used, as expected. From a reliability point of view (statistically significant), the values F and P are lower than 0.01, indicating a strong link, with the amendment that this could be induced by the limited number of observations and the exceptional nature of the measures. Thus, a further research approach could be the introduction into the analysis of other conjuncture indicators, such as, for example, the level of confidence in the economy.

4 Conclusions

The COVID-19 pandemic and the restrictions that were imposed influenced the global labor market, with a spike in unemployment in March and April 2020, but then steadily recovering. Even though all the studied economic sectors responded similarly to the initial shock of the COVID-19 pandemic, most layoffs were found in leisure and hospitality, as well as lodging and food services, as various restrictions were imposed to prevent the virus from spreading.

The strong negative correlation between layoffs and GDP in the United States implies that the lockdown policies implemented in the first few months after the pandemic erupted led to the GDP decline during that period.

Our regression analysis shows that, relative to the R Square coefficient, approximately 56% of the change in the unemployment rate can be explained by the introduction of restrictive measures.

While several vaccinations were released in various countries at the time of writing this paper, recent evidence indicates that the pandemic is far from over, suggesting that the business sector must respond rapidly and adjust to the current economic, social, and political reality.

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